Science Progress.

No. 30. AUGUST, 1896. Vol. V.

LIGHT AND ELECTRIFICATION.

II.

Continued from vol. iii., p. 185.

WHEN we come to consider how to imagine the mode by which light discharges an electrified surface, one of the first hypotheses is that it may be by a kind of proof-plane action, the illuminated surface being disintegrated and its charged molecules evaporated away, taking their charges with them.

The first objection to such a hypothesis is that the disintegrating action of light ought to be otherwise perceptible either to microscopic inspection or to a delicate balance which should determine the loss of material.

It has, however, often been suspected that metals may evaporate more or less, and the fact of their smell seems to establish the fact, so it may be well to consider how small a loss of material will serve to explain the observed loss of electrification.

If we assume that each molecule so evaporated has the ionic charge on one of its atoms reversed, or, more simply, if we assume that each atom carries off a quantity of electricity of the order 10^{-11} electrostatic unit, its maximum possible and customary value, then the amount of electricity associated with the one gramme of evaporated silver is 900 contants or 3×10^{12} electrodal units.

Now a silver plate 14 centimetres square, under certain conditions of arc illumination, was found in the writer's laboratory to lose negative electricity at the rate of 30 electrostatic units per minute when kept electrified to 80 volts in fairly free space. Hence the time that would elapse before the above plate would lose a tenth of a milligramme of its substance is ten million minutes or nearly a century.

Such a ratio of loss as that could not be detected by a balance, even in the case of silver, which is the substance most suitable for detecting a small electrolytic loss by weight. But now suppose that the discharge is not of so atomic a character, but that little flakes or pieces of the metal are driven off under the electric stress, so that the charge per gramme lost is very much less.

In that case the disintegration of surface might be perceived, but there are many difficulties in the way of supposing such an action.

The electric tension even when on the verge of disruption, when the surface is charged to many thousand volts, is by no means comparable to the forces of cohesion.

And the action of light occurs at so low a tension that it is impossible that its action is a mere bringing down of the limit at which disruptive discharge begins.

The action of light is much more like a quiet atomic or molecular process than it is like a disruptive discharge from the substance in bulk.

It may, however, be worth noticing that the electric repulsive force experienced by an atom *when on a surface charged to the disruptive limit* is not incomparably less than the average force of cohesion acting on such an atom. The tenacity of a metal may be taken as 10^9 cgs. units, or about 10^{-7} degree, per superficial molecule. The electric force acting on an atom in a potential gradient of 30,000 volts per centimetre, which is the disruptive limit under ordinary atmospheric conditions, is about 10^{-9} degrees—one-hundredth of the average cohesive force; so it would not be unduly speculative to conceive it possible that circumstances connected with heat and other motors should occasionally

render individual atoms detachable under stresses approaching so near to the average limit, and this would be one way of representing disruptive discharge.

Against this, however, must be set the fact that the disruptive limit depends greatly on the atmospheric conditions, on the pressure and nature of the gas in contact with the metal; therefore it would appear that even for disruptive discharge we must look to an interaction between the molecule of the metal and that of the medium in contact with it, rather than to a simple disruption of the metal alone.

What is certain is that the charge is carried away by particles (atoms or otherwise) which travel along the lines of force to the oppositely electrified surfaces. It may conceivably be that the conveyers of charge are the electrons themselves; in other words, that the negative ends of the lines of force are detached from the charged body under the action of light, and that the line therefore promptly shuts up. It is more probable, however, there are no such detached electrons or atomic charges divorced from matter, but that the negative charge is conveyed by material atoms, whether they be the atoms of the metal or of the surrounding gas. To examine the question whether the conveying atoms belonged to the metal or to the gas, a number of experiments have been made in my laboratory with the object of testing the presence of metallic particles or vapour near an electrified metal rapidly discharging under the action of light.

The metals most easy to detect in small quantities are in general perhaps silver, iron and sodium. Silver, by its reflecting power when deposited upon glass; iron, by its magnetic properties; and sodium, by the light it causes a non-luminous flame to emit. Silver plates, with their clean edges opposed to the surface of plate glass, were oppositely electrified so that any charge given off from the silver edge should be deposited upon the glass as upon the dielectric of a Leyden jar, and were kept thus strongly illuminated by an arc light for hours; the glass was then examined for transparency. A decided deposit was found near the illu-

minated region, but there appeared nothing metallic about it, and it was easily dusted off. It seemed to be merely dust out of the air. So the experiment was repeated in a dust-free chamber, containing air filtered slowly through long tubes of cotton-wool, and now not the faintest local dimming of the surface could be observed, although the illumination and electrification lasted for days. So the answer for silver was in the negative.

Next a non-magnetic substance was hung in a powerful converging magnetic field in the neighbourhood of clean illuminated and oppositely electrified iron, to see if by condensation of evaporated iron, it was possible that it became magnetic. A minute torsion-bar of copper suspended over a clean, conical, vertically pointing electro-magnet's pole was the best arrangement. There were difficulties about this experiment on account of electrodal and other forces, but so far as disturbance could be eliminated the result for iron was also negative.

Then the most elaborate series of observation was made on metallic sodium kept in an atmosphere of highly purified hydrogen, the gas being supplied through a long series of drying tubes, and kept burning as a small jet just after it had passed over the sodium surface. By a mechanical arrangement the sodium could be cut to a clean surface from outside, and when the gas was pure this surface lasted a fairly long time, and under illumination it discharged electricity supplied by several dry piles in series, so that a considerable supply of electricity could be drawn from the flame whenever light from an arc lamp was allowed to fall on the sodium surface through a quartz window. The flame was looked at either direct or through a small spectroscope, and though the sodium line could not be kept wholly absent, its occasional presence depended in no way on whether the surface was positively or negatively or not at all electrified, nor on whether the light was or was not shining on it.

Hence I conclude that the discharge of electricity from illuminated surfaces is not effected by evaporation of those surfaces, but that the molecules which convey the charge

belong to something in the gas, and not to the illuminated body.

It may be asked whether dust in the air has any part in the action, but, so far as I can find, it has none at low tensions. The discharge rate from the silver surfaces, for instance, was just about as rapid in a dust-free atmosphere as when dust was present.

The proof that the discharge is effected by molecules of some kind, or at least by something which travels along the lines of electrostatic force was given by Righi. He electrified a small metallic cylinder of which only one generating line was free from varnish, and therefore clean enough to discharge electricity. This cylinder being negatively electrified in front of an earthed plate, an exploring terminal of an electroscope could ascertain which part of the plate was receiving a charge, as the cylinder was rotated on its axis, a movable slit being arranged in the plate for this purpose; and it was found to be always near one extremity of a circular arc of which the discharging line constituted the other extremity. He further found that if the illuminated body were free to move it receded like an electric windmill, proving that it had imparted its charge to something possessing appreciable inertia.

The inertia of the gaseous particles would indeed cause some divergence from the above circular orbits in which the electrical force is urging them, but the force is so great and the mass is so small that the deviation is not noticeable. Moreover, the charged atom has to make its way among a crowd of others by a process very similar to what occurs in electrolysis, so that the path of the electric charge follows almost accurately the line of electric force. In *that* sense it may be said to represent the motion of an electron or free electric charge, without committing the speaker to the hypothesis that such charges divorced from their usual boundary conditions on matter can really exist.

If a gaseous atom can receive a charge from an electrified surface there is no difficulty in understanding what it does with it, nor how, by such a process, the electrified body gets discharged, but the difficulty is to realise how an

atom can so receive a charge. Under ordinary circumstances it is certain that gas molecules cannot acquire a charge until the electrical tension rises to the disruptive point; but there is a certain condition into which a gas can be thrown, similar, if not identical, with that which chemists speak of as dissociation, wherein a gas becomes a conductor, that is to say, its particles do really act as carriers of electric charges, and may be spoken of as detached and specifically charged atoms.

Now in a vacuum tube, we learn experimentally from Mr. Crooks, that at high vacua the negatively charged atoms are vigorously repelled from a negative electrode, and, shooting out from it in straight lines, constitute what are known as cathode rays. It appears as if the electric discharge itself were carried on in a vacuum tube by a quiet, imperceptible, electrolytic action, originating at the anode or positive electrode, that this discharge fills the whole tube with positive electrification up to within a short distance of the cathode. In this short distance there is accordingly a steep potential gradient, and any stray negative atoms finding themselves therein are shot out of it with immense velocity, and constitute what are called cathode rays. Some doubt has been felt as to the essential nature of cathode rays, but there is hardly any good reason for the belief that they are anything else than a stream of negatively charged atoms of matter. They need not have recently received a charge, their charge may be intrinsic; what we observe is their repulsion, not as if guided through a resisting medium by electric force, but as if propelled violently inside a thinned layer and left to the first law of motion nearly.

Great interest has been felt in this cathode stream for a quarter of a century, but within the present year its importance has become immense owing to the discovery of Röntgen that a surface on which the stream impinges becomes capable of emitting a novel kind of radiation which travels even more persistently in straight lines, and is not readily stopped by material obstacles. This discovery must ultimately throw a great deal of light upon the whole

subject, and it is over soon to attempt to forecast its probable development; nevertheless a partial attempt may be made for what it is worth.

The new radiation appears to differ from ordinary ultra-violet radiation only in the matter of wave-length. Its wave-length is probably extremely short, not vastly greater than the size of atoms, and all its other known properties and peculiarities will follow from that according to known theories of dispersion, especially the electromagnetic one of von Helmholtz.

Now this X radiation, when it falls upon an electrified surface, discharges it, somewhat in the same fashion that ultra-violet light does; but whereas light discharges electricity solely, or at any rate chiefly, of the negative sign, this X radiation discharges both positive and negative; and indeed it seems to act by converting the gas or other insulating material near a charged body into a conductor. This it probably does by dissociating the substance into charged atoms which are then free to act as carriers, and speedily convey to a distance the charge of the electrified body by journeys along the lines of force.

It may be that ultra-violet light acts in somewhat the same way, but not in exactly the same way. The air is transparent to ultra-violet light, it is not perfectly transparent to X rays.

There is no difficulty in supposing that the X rays dissociate some ingredient of the atmosphere, but there is great difficulty in supposing ordinary ultra-violet light to be able to do so. What the ultra-violet light chiefly does is to promote or to create the conditions necessary for the ready interchange of electric charge between gas and solid; and that this is so is practically proved by the great importance of the nature of the solid surface, as well as of the gas in contact with it. The gas seems indeed of secondary importance, but the cleanness and oxidisability of the solid is essential to a rapid and ready discharge with ordinary light from the visible spectrum. High ultra-violet light can act indeed over a wider range, and whereas light of long wave-length can only discharge negative

electricity, it is probable that light of extremely short wave-length can discharge positive also, and from surfaces not specially clean nor oxidisable.

The X rays seem to go farther in the same direction; that is to say, their activity does not appear to depend much upon the nature of the surface, nor do they seem to discriminate much between positive and negative electrification.

We may surmise, then, that long-wave light is effective in promoting discharge only when dissociated or incipiently dissociated atoms are already present in the neighbourhood of the surface. It is otherwise known that strongly electro-positive substances, like clean sodium or zinc, are surrounded by a number of electro-negative (chiefly oxygen) atoms, straining to get at it. And, similarly, a negatively charged surface may be surrounded by a number of straining positive atoms. Under these circumstances it is not difficult to picture the result of impinging waves of light, and of the electrical oscillations which they must necessarily set up, as resulting in an interchange of electricity between the surface and the gas which otherwise might not have occurred.

When positive electricity has thus been received by the metal from the air under the action of light, detached negative ions will be left in the atmosphere, and these will be repelled by the body if kept negatively electrified, and so may constitute a kind of feeble cathode ray.

Thus it appears as if there were a sort of reciprocal action; the impact of light on a negatively electrified surface results in the production of something akin to cathode rays, and the impact of cathode rays upon a positively electrified surface results in something akin to light.

Another instance of reciprocity has also been observed. Certain substances exposed to X rays fluoresce strongly, that is, emit light which in some cases persists an appreciable time, and some of these substances when made to fluoresce by exposure to light begin to emit X rays and continue to emit them for long after, as has been observed by M. Becquerel.

There is one matter dealt with in the last article which requires more cautious handling than it then received, and

that is the discharge of positive electricity—*i.e.*, the reception of negative by certain substances. It is a phenomenon which undoubtedly occurs as an experimental fact, but if we proceed to look into the cause of it we find its detailed character by no means so obvious Certainly it depends a great deal on the surroundings, and there is reason to believe that if a positively charged body were surrounded by a surface incapable of giving off negative electricity, then the apparent discharge of positive might not occur.

The question is complicated by the simple facts (*a*) that we cannot have a charged body without an equal opposite charge on surfaces opposed to it, and (*b*) that every surface reflects and scatters some of the incident light which therefore partly falls upon the oppositely electrified surface. Hence when a positively charged body loses its charge, it may be not through a direct action of the light upon itself, but by reason of the action of the reflected and scattered light on the negatively electrified surfaces in its neighbourhood.

On this hypothesis a surface which appears to lose positive more quickly that negative is one which of itself hardly loses any electricity at all; it loses negative slowly but it is exposed to surfaces which can emit it more quickly, and hence when it is positively electrified and they are inductively negative, it receives from them a negative charge more rapidly than it was able to give one out.

A large number of experiments have been made in the writer's laboratory to test this point, mostly by means of regular reflectors so as to avoid scattered light as far as possible; the details are somewhat technical and troublesome, and the very dust of the air is apt to scatter a good deal of active light; but the result is, on the whole, to substantiate the above-mentioned idea, which also possesses the powerful support of Messrs. Elster and Geitel, that the loss of positive electricity under the action of light is an indirect and secondary phenomenon.

It appears, however, that under X rays both points of electricity are discharged equally, and if these X rays are, as everything now indicates them to be, an extension into

very much higher regions of the spectrum of transverse ethereal vibrations, then it must become a question of degree and of wave length, as implied above by the writer, and no perfectly simple statement can be made.

The activity of ordinary sunlight in promoting the discharge of electricity into the atmosphere is evidently a question of great meteorological importance; but it is enormously affected by the condition of the earth's atmosphere, At high elevations the rays are very active, but in valleys the power is less, and on many days in a town there is hardly any power left at all. The writer's assistant, Mr. Davies, constructed a portable apparatus with which he made many observations in Wales and other places during last summer at different heights and at different periods of the day. The results are such as might naturally have been expected, but we do not yet know whether the sun emits any X rays at all detectable in the higher region of the atmosphere, or whether this latter variety of radiation is an artificial product recently introduced by man into the operations of Nature.

OLIVER LODGE.

AN EXTINCT PLANT OF DOUBTFUL AFFINITY.

IN two previous articles[1] some account has been given of the genus *Sphenophyllum*, with special reference to the structure of the strobilus. I now propose to add a brief summary of our knowledge of this interesting type of extinct plants, which has been fully dealt with by Williamson and Scott in their memoir on *Calamites, Calamostachys*, and *Sphenophyllum*.[2]

Every collector of Coal-Measure plants must be familiar with the fragments of slender stems bearing regular whorls of wedge-shaped leaves, which are frequently found in the Upper Carboniferous shales, or in the ironstone nodules of Coalbrookdale and other places. Writing in 1822, Brongniart[3] describes and figures a well-preserved impression of a species of *Sphenophyllum* under the name *Sphenophyllites emarginatus*, and speaks of it as a plant without any living generic analogue. In the classic *Prodrome d'une histoire des végétaux fossiles*, the same author gives the following definition of this fossil genus, and adopts the generic name *Sphenophyllum*[4]:—

"Tige simple, articulée ; feuilles verticillées, au nombre de six à douze, distinctes jusqu'à leur base, cuneiformes, entières ou émarginées, ou même bifides, à lobes plus ou moins profondément laciniés, presque dichotomes. Fructification inconnue." It is unnecessary to give any historical sketch of the various opinions expressed by later writers on the nature of this characteristic plant, but we may at least point out, that it has been held by certain authors that the plant regarded by Brongniart and others as an autonomous genus, was in all probability a particular form of calamitean branch. Stur was one of those who held this view, and in

[1] "SCIENCE PROGRESS," vol. i., p. 54, and vol. iv., p. 261.

[2] Williamson and Scott. [3] Brongniart (1). Pl. xiii., fig. 8.

[4] Brongniart (2), p. 68.

his great work on *Calamites*, several specimens are figured and described as evidence of the calamitean nature of *Sphenophyllum*. A restoration of *Calamites* with sphenopylloid and other branches, given in his monograph, serves to illustrate this view.[1] More recent investigation has, however, conclusively proved that Brongniart's original definition holds good. There can no longer be any doubt that *Sphenophyllum* is a very well-defined generic type holding a somewhat isolated position in the plant kingdom.

From structureless casts and impressions, we learn that the genus is characterised by a comparatively slender articulated stem bearing a series of superposed whorls of leaves. The number of leaves in each verticil is always some multiple of three, frequently six, or it may be nine, twelve, eighteen, or more at each node. The leaves have usually a wedge-shaped form, and the lamina is traversed by dichotomously branched veins. In older forms, again, the leaves are much narrower, and each segment in a whorl has a single median vein. The narrow-leaved species, such as *Sphenophyllum myriophyllum* Crép., etc.,[2] cannot always be readily distinguished from the well-known *Asterophyllites* form of foliage; but as Zeiller[3] points out, a careful attention to the general habit of the plant, and the presence of bifurcations in the leaves, should enable us to separate these two generic forms. Another feature worthy of note is the hetrophylly occasionally exhibited by this genus.[4] The occurrence on the same plant of broad and finely dissected leaves, naturally suggested to some authors[5] the idea of an aquatic plant; but the histological features are not such as are usually associated with water plants.

Examples of *Sphenophyllum* met with in English Coal-Measures do not, as a rule, attain any considerable length. By far the longest stem which has come under my notice is one in the Geological Survey Museum in Vienna; in this specimen there is an axis 4 mm. in breadth with a length of 85 cm., giving off a slender branch 61 cm. in

[1] Stur, p. 69. [2] Zeiller (1), pl. lxii. [3] Zeiller (2), p. 674.
[4] Schenk, pl. xliv., fig. 1; Seward, p. 3, fig. 1. Etc. [5] *E.g.*, Newberry.

length. Occasionally long and narrow strobili are found attached to the vegetative branches; in external appearance they resemble to some extent the corresponding structures in calamitean plants, but a closer inspection at once reveals a very distinct individuality for this type of strobilus.

In Williamson and Scott's work three specific forms of Sphenophyllum are dealt with. We may first of all give a short description of the general type of structure characteristic of the genus, and afterwards attempt a diagnosis of the specific characters.

Primary Structure of the Stem.—Traversing the young stem there is a single vascular cylinder or stele, consisting of a triarch and centripetally developed axial strand of xylem. A transverse section of such a stem shows in the centre a triangular group of reticulate, scalariform, and spiral tracheids, the latter having a smaller diameter than the others, and constituting the three protoxylem groups at the prominent angles of the solid vascular axis. It is a fact of considerable interest, that we have in this primary structure an arrangement and manner of development of the tracheids which a student of Botany is always taught to regard as characteristic of root rather than stem structures. External to the xylem there is occasionally preserved a thin-walled phlœm tissue, and beyond this may be recognised the pericycle or limit of the stele. Passing beyond the central cylinder we have a thicker walled cortex, of which the outermost layer or epidermis has not been clearly preserved.

Secondary Structure.—On examining a series of transverse sections of stems in different stages of secondary growth, we find that the triangular group of primary tracheids becomes gradually surrounded by radially disposed rows of large elements, forming in older stems a considerable thickness of secondary wood, in which, as a rule, there is a striking uniformity in the diameter of the tracheæ. Smaller xylem elements occasionally occur, but, as in the majority of Coal-period plants, there are no definite rings of growth. The development of secondary xylem, beginning in the interfascicular region, that is, in the broad

bays of the primary wood, soon extends to the fascicular regions, and thus completely encloses the axial strand. The amount of secondary wood naturally varies considerably in different sections, the tracheids in a single radial row varying from one to thirty-seven in number. The medullary rays either extend as continuous lines of parenchyma through the whole thickness of the wood, or occur in the form of cell groups at the angles of the tracheids; in the latter case the apparently isolated clusters of parenchyma are united by connecting cells stretching across the radial walls of the reticulately pitted tracheids. Owing to the smaller diameter of the fascicular tracheæ, the secondary xylem exhibits a fairly obvious division into six groups, three broader masses of interfascicular tracheids, alternating with three smaller groups of radial rows of fascicular tracheids, tapering towards the protoxylem angles of the primary xylem.

The formation of periderm is another characteristic feature in the secondary growth of a *Sphenophyllum* stem. A phellogen or cork cambium appears to arise in the pericycle, and at a later stage the phlœm parenchyma takes part in the development of cork tissue. It is often a matter of some difficulty to distinguish between the true phlœm and the internal periderm. The latter consists of short cells in regular series, the former being made up of much longer elements, which may possibly be sieve-tubes.

Leaves.—The most perfect example of a petrified leaf of *Sphenophyllum* so far described, is one figured by Renault.[1] In transverse section the lamina is seen to be composed of thin-walled loose parenchyma, with small groups of tracheids marking the position of the veins. The epidermal layer on the upper and under surface consists of fairly thick-walled cells, with indications of stomata. The most distinctly preserved stoma has, however, been figured by Solms-Laubach[2] from the epidermis of one of the leaf segments of a strobilus; in this there are two narrow guard cells with two larger subsidiary cells.

[1] Renault (1), pl. ix., fig. 6; and (2), pl. xvi., fig. 1.
[2] Solms-Laubach, pl. x., fig. 9.

Root.—As regards the roots of this genus we have but little information. Renault[1] has figured a small silicified example from Autun, with a diameter of 2 mm. In the centre there appears to be a diarch primary xylem bundle, surrounded by concentric rows of reticulately pitted tracheids. It is possible that two specimens figured by Felix,[2] may represent adventitious roots being given off from a *Sphenophyllum* stem. He speaks of them as examples of lateral branching, but their precise nature is, by no means, very easy to determine.

Fructification.—The fructification of *Sphenophyllum* as first described by Williamson and Zeiller,[3] may be thus defined :—An axis traversed by a triangular strand of primary xylem tracheids, bearing at intervals of 1·5 to 2·5 mm. similar leaf verticils consisting of a number of linear lanceolate segments, fused in their lower portions into an open funnel-shaped disc. The numerous sporangia occur in 2 to 4 concentric circles on the upper surface of each disc, in radial sections of a cone presenting the appearance of a row of 2 to 4 sporangia between each whorl of bracts. Each sporangium is attached to a slender stalk springing from the upper surface of the leaf disc, and terminates in a hooked tip facing the axis of the strobilus, thus resembling the attachment of an anatropous ovule to its funicle. Each sporangiophore possesses a strand containing a few xylem tracheids. At the point where the stalk or sporangiophore passes into the sporangium, the epidermal cells have thicker walls, and appear to represent an annulus, the sporangia dehiscing by a longitudinal slit on the side away from the stalk. The sporangia are isoporous, and the spores have a reticulately marked outer membrane.

In a recent paper by Count Solms-Laubach[4] an exceedingly interesting addition is made to our knowledge of the *Sphenophyllum* strobilus. While confirming in the main the results arrived at by Zeiller, Williamson, and Scott, he describes a new type of fructification from the neighbour-

[1] Renault (1), pl. viii., fig. 5 ; and (2), pl. xv., fig. 6.

[2] Felix, pl. vi., figs. 2 and 7.

[3] See "SCIENCE PROGRESS," vol. i., p. 54.

[4] Solms-Laubach.

hood of Cracow. In this species, *Bowmanites Rômeri*, Solms, the sphorangiophores springing from the upper surface of each whorl of bracts, bear at the apex two sporangia instead of one as in previously known forms. Between each pair of sporophyll verticils there are at least three whorls of sporangia, the sporangia are almost sessile, and attached to short sporangiophes in the same manner as in the fructifications already described. Each sporangiophore bifurcates towards the distal end, and the sporangia are attached to the diverging forks in much the same manner as the ovules of *Zamia* and *Encephalartos* are suspended from their carpophylls. As regards the nature of the spores and the annulus-like cells of the sporangial stalks, *Bowmanites Römeri* agrees closely with the other forms. As happens so frequently in palæobotanical research, we are able to examine in detail the characters of an isolated member of an individual plant, without knowing anything of the other parts of the same species. In the present instance we are ignorant of the nature of the leaves which were borne by the stem to which *Bowmanites Römeri* was attached. There can, however, be little or no doubt that we have to do with a *Sphenophyllum* strobilus, differing in an important respect from the ordinary type. The plants included in the genus *Calamites* are known to have possessed cones of more than one type of structure; and it would appear that this was also the case with *Sphenophyllum*. When our data are more complete it may be possible to institute new generic terms for plants which are now assigned to these somewhat comprehensive genera, but for the present it is better to err on the side of too wide a meaning for generic terms, than to attempt to found new genera on insufficient evidence.

In addition to a full account of *Bowmanites Römeri*, Solms discusses at some length another sphenophylloid strobilus originally described by Weiss as *Bowmanites Germanicus*[1], and suggests that this species as well as that described by Binney under the name of *B. Cambrensis*[2]

[1] Weiss, Pl. xxi., fig. 12. Solms-Laubach, Pl. ix., fig. 7.

[2] Binney, Pl. xii., figs. 1-3.

may be identical with *Bowmanites Dawsoni* of Williamson.

It remains for us to consider the probable systematic position of this genus. It is undoubtedly a Vascular Cryptogam, characterised like so many other Palæozoic representatives of the group by a considerable development of secondary xylem and phloem.

Zeiller has expressed the opinion that *Sphenophyllum* should be included in the *Filicinæ*, and in the neighbourhood of the ferns; he institutes a comparison with *Marsiliaceæ* and *Ophioglosseæ*. The French author draws special attention to the distinct resemblance between the sporangiophore of *Sphenophyllum* and the sporocarp stalk in *Marsilia*. Subsequent writers have very properly pointed out that we cannot well make use of this superficial resemblance, in attempting to discover characters of real morphological importance. The single sporangium of *Sphenophyllum* differs in an important degree from the elaborate sporocarp or highly specialised foliar structure of *Marsilia*. The fossil genus is no doubt eusporangiate, and in that respect comparable with *Ophioglossum*, but the fertile spike of the latter differs widely from the sporangia and sporangiophores of the former. Potonié's[1] comparison of *Sphenophyllum* with *Salvinia* does not render any material assistance to our endeavours to assign the fossil form to its true position. "We must be content for the present to leave this remarkable genus in its isolated position, in the hope that the extensive knowledge of its organisation which we now possess may in the future afford an adequate basis for comparison, when additional forms of Palæozoic Cryptogams shall have been brought to light."[2]

This conclusion arrived at by Williamson and Scott, and accepted by Solms-Laubach, may perhaps be best realised by making use of the term *Sphenophylleæ* as a class designation. This has been done by Schenk in Zittel's *Handbuch der Palæontologie*,[3] and is the course followed in a recent paper by Kidston[4].

[1] Potonié.
[2] Williamson and Scott, p. 946.
[3] Zittel.
[4] Kidston.

PTERIDOPHYTA.

Class—SPHENOPHYLLEÆ.

Genus SPHENOPHYLLUM.—Brongniart 1828 (*Sphenophyllites*, Bronguiart, 1822). Stems comparatively slender (1·5 to 15 mm.?), articulated, usually somewhat swollen at the nodes, and marked by more or less distinct ribs and grooves which do not alternate at the nodes, occasionally a single branch given off at a node. Leaves in verticils, usually the leaves of each whorl are equal in size, but may be unequal,[1] in multiples of 3, 6, 9, 12, 18 or more. The leaves of successive whorls superposed, not alternate; varying in form from cuneate, with narrow base and multinerved lamina having an entire or toothed anterior margin, to narrow linear uninerved forms, or with a deeply dissected lamina having dichotomously branched segments.

Stem monostelic, with a triarch triangular strand of centripetally developed primary xylem, consisting of reticulate, scalariform and spiral tracheæ; the protoxylem elements being situated at the blunt corners of the xylem strand, from the angles are given off the foliar bundles, either one or two from each angle.

Secondary xylem consists of radially disposed reticulately pitted tracheæ, developed from a cambium layer. Phloem of thin walled tissue including sieve-pitted tube-like elements and phloem parenchyma. Both xylem and phloem traversed by medullary rays of parenchymatous cells. Cortex largely composed of fairly thick walled cells; and in older stems cut off by the development of deep-seated periderm.

Fructification in the form of long and narrow strobili, in some cases reaching a length of 12 cm., and a diameter of 14 mm. A slender axis bearing whorls of numerous linear lanceolate bracts fused basally into a coherent funnel-shaped disc, bearing on its upper surface sporangiophores[2] and

[1] Zeiller (2), p. 675.

[2] The strobilus of *S. trichomatosum*, Stur, figured by Kidston, is described as having *sessile* sporangia. On this point see Williamson and Scott, p. 942. An examination of Kidston's specimen certainly conveys the idea of sporangia without stalks, but the evidence is not conclusive.

sporangia. Isosporous, possibly in some forms heterosporous.[1]

SPHENOPHYLLUM PLURIFOLIATUM. Williamson and Scott, *Phil. Trans.*, vol. clxxxv., p. 920, pls. lxxv., lxxxiii., 1894.

Asterophyllites Sphenophylloides. Will. *Phil. Trans.*, vol. i., p. 41, pls. i.-iv., 1874. [Type specimens from the Coal-Measures of Oldham in the Williamson Collection, British Museum.]

Many linear leaves in each whorl (18 to 24?). Surface of young stems marked by three longitudinal grooves. Medullary rays in the form of groups of parenchymatus cells in the spaces between the truncated angles of the secondary tracheæ; the groups connected laterally by means of radially elongated cells. Continuous rows of medullary ray cells rare. Deep seated periderm.

S. INSIGNE. (Williamson). *Phil. Trans.*, vol. clxiv., p. 41, 1874, and Williamson and Scott. *Phil. Trans.*, vol. clxxxv., p. 926, pls. lxxvi., lxxxiii., lxxxiv., lxxxv., 1894.

Asterophyllites insignis. Williamson. Mem and Proc., *Manchester Lit. and Phil. Society*, vol. iv. [4], p. 13, 1891. [Type specimens from the Carboniferous beds of Burntisland; in the Williamson collection, British Museum.]

Leaves probably not more than six in each whorl. Cortex grooved in young stems. Tracheæ of primary xylem smaller in diameter than in *S. plurifoliatium.*

S. plurifoliatum.—Longitudinal canal at each angle of the primary xylem strand; spiral tracheæ more numerous than in the preceding species. Outer cortex of thinner walled cells than in *S. plurifoliatum.* Tracheæ of secondary xylem with scalariform markings on radial walls. Medullary rays of regular rows, of one to two cells in breadth, extending through the entire thickness of the xylem. Phloem contains wide sieve- tube-like elements. Deep-seated periderm.

In describing the fructification of *Sphenophyllum*, Wil-

[1] Kidston, in his definition of *Sphenophyllum*, speaks of it as heterosporous. The heterosporous example described by Renault is, however, extremely doubtful, and as yet we have no actual proof of the heterospory of this genus (see Kidston, p. 58; also Williamson and Scott, p. 942).

liamson and Scott adopt the generic name of *Sphenophyllum*, while Count Solms prefers Binney's term *Bowmanites*. The question of terminology in palæobotany is often a difficult one. When we have very definite evidence that a cone belongs to a certain genus, it would appear the obvious course to speak of both under the same generic name. On the other hand there is something to be said in favour of retaining a special term for detached strobili, which cannot be certainly referred to their respective vegetative stems. In the case of *Sphenophyllum Dawsoni* (Will.) it may be, as suggested by Zeiller, the strobilus of *S. cuneifolium* (Sternb.); as our knowledge increases, detached cones must frequently be referred to certain specific forms of stems, and the confusion would probably be lessened if a distinct generic name were in the first instance assigned to isolated cones. The use of distinctive names for the fructification of genera has been found convenient in the case of *Lepidodendron*, *Sigillaria*, and *Calamites* (*Lepidostrobus*, *Sigillariostrobus*, and *Calamostachys*). Such names suggest the strobili of the different genera, and in looking through a list of species one recognises at a glance those which stand for reproductive structures. Solms does not adopt the generic designation of the fructification of *Sphenophyllum* corresponding to *Calamostachys*, as he considers such a term as *Sphenophyllostachys* too long and inconvenient. In coining new names sesquipedalian words should, as a rule, be avoided, but in discarding the genus *Sphenophyllostachys* one is departing from a recognised and convenient custom for a reason which hardly seems adequate. *Bowmanites* is the older name, but now that its true position is known, it should be replaced by a term which expresses the fact of its connection with *Sphenophyllum*. I would suggest, therefore, that the name *Sphenophyllostachys* be adopted for the strobili of *Sphenophyllum*.

SPHENOPHYLLOSTACHYS DAWSONI (Will.). (*Mem. Manchester Lit. and Phil. Soc.*, vol v., p. 28, pls. 1-3, 1871.)

VOLKMANNIA DAWSONI. *Ibid.*

BOWMANITES DAWSONI. Weiss. *Steinkohlen Calamarien*, ii., p. 200, 1884.

Slender axis bearing alternating whorls of bracts (14 to 20), cohering basably and free distally as long linear segments extending upwards through about six internodes. A single verticil of long and slender sporangiophores on each whorl of bracts. The sporangiophores bend inwards at the apex and bear single sporangia. Isosporous. Spores with spinus outgrowths. Probably the strobilus of *Sphenophyllum cuneifolium* (Sternb).

SPHENOPHYLLOSTACHYS RÖMERI (Solms-Laubach). *Jahrb. Geol. Reichs. Wien*, Bd. 45, Heft. 2, p. 225, Pls. ix. and x., 1895.

Axis and whorls of bracts similar to those of *S. Dawsoni*, except that in each verticil of bracts the free linear segments extend nearer to the strobilus axis. More than one whorl of sporangiophores on each whorl of bracts, probably three. Each sporangiophore forked distally, and bearing a sporangium on the inwardly bent tip of each diverging branch. Isosporous. Spores similar to those of *S. Dawsoni*.

Genus TRIZYGIA. Royle. *Botany and Nat. Hist. Himalayan Mts.*, p. 431, 1834.

This generic name was proposed in 1834 for a genus of plants occurring in the Glossopteris flora of India.[1] Little is known as to its real affinities or structure, but Zeiller[2] has recently pointed out the doubtful generic value of its characters, and he regards it as most probably a form of *Sphenophyllum*. The slender stem bears verticils of wedge-shaped leaves in three pairs at each node, the anterior pair being smaller than the two lateral pairs.

BIBLIOGRAPHY.

BINNEY, E. W. Observations on the Structure of Fossil Plants in the Carboniferous Strata. *Palæontological Society*, pt. ii., 1871.

BRONGNIART, A. (1). *Sur la classification et la distribution des végétaux fossiles en général*, 1822.

BRONGNIART, A. (2). *Prodrome d'une histoire des végétaux fossiles*, Paris, 1828.

[1] For figures see Feistmantel, pls. xi. A. and xii. A.

[2] Zeiller (2).

FEISTMANTEL, O. The Fossil Flora of the Lower Gondwanas. II. The Flora of the Damuda and Panchet Divisions. *Mem. Geol. Surv. India*, vol. iii., Calcutta, 1881.

FELIX, J. Untersuchungen über den inneren Bau Westfälischer Carbon-Pflanzen. *K. Preuss. Geol. Landesanst.*, p. 153, 1886.

KIDSTON, R. On the Fructification of *Sphenophyllum trichomatosum*, Stur, from the Yorkshire Coal Field. *Proc. R. Phys. Soc., Edinburgh*, vol. xi., p. 56, 1890-91.

NEWBERRY, J. S. The Genus *Sphenophyllum*. *Journ. Cincinnati Nat. Hist. Soc.*, p. 212, 1891.

POTONIÉ, H. Ueber die Stellung der Sphenophyllaceen im System. *Bericht. deutsch. bot. Gesell.*, Band. xii., Heft 4, p. 97, 1894.

RENAULT, B. (1). Nouvelles recherches sur la structure des *Sphenophyllum* et sur leurs affinités botaniques. *Ann. Sci. Nat. Bot.* [6], vol. iv., p. 277, 1876.

RENAULT, B. (2). *Cours de botanique fossile*, vol. ii., 1882.

SCHENK, A. In Richthofen's *China*, vol. iv., Berlin, 1883.

SEWARD, A. C. *Sphenophyllum* as a Branch of *Asterophyllites*. *Manchester Lit. and Phil. Soc.*, p. 1, 1890.

SOLMS-LAUBACH, GRAF ZU. *Bowmanites Römeri*, eine neue *Sphenophyllum* Fructification. *Jahrb. k. k. Geol. Reichsanust. Wien*, vol. xlv., Heft 1, p. 225, 1895.

STUR, D. Die Carbon-Flora der Schatzlarer Schichten. Abth. II. Die Calamarien. *K. k. Geol. Reichs.*, vol. xi.; Abth. II., Wien, 1887.

WEISS, C. E. Beiträge zur fossilen Flora, III. Steinkohlen-Calamarien, II. *Abth. Geol. Specialkarte Preuss. Thüring-Staaten*, Band v., Heft. 2, Berlin, 1884.

WILLIAMSON, W. C., and SCOTT, D. H. Further Observations on the Organisation of the Fossil Plants of the Coal-Measures. Part I. *Calamites*, *Calamostachys*, and *Sphenophyllum*. *Phil. Trans.*, vol. clxxxv. B., p. 863, 1894.

ZEILLER, R. (1). Bassin houiller de Valenciennes. *Études de gites Minéraux*, Paris, 1886.

ZEILLER, R. (2). Sur la Valeur du Genre *Trizygia*. *Bull. Soc. Géol. France* [3], vol. xix., p. 673, 1891.

ZITTEL, K. A. VON. *Handbuch der Palæontologie*. Abth. II. Palæophytologie. Schimper & Schenk, 1890.

A. C. SEWARD.

THE WORK OF THE PORTUGUESE GEOLOGICAL SURVEY.

THE geology of the Spanish Peninsula is imperfectly understood; but it is not without a special interest of its own. It is here, if anywhere in Europe, that we should expect to find among the more ancient faunas some indications of a warmer temperature than prevailed farther north, or of some other difference due to difference of latitude. It is the only part of Southern Europe where there is a really extensive development of the Lower Palæozoic rocks; but unfortunately these are still almost unknown.

Of late years the re-organisation of the geological surveys of Spain and Portugal has led to a great increase in our knowledge of those countries, and the recent appearance of a new part of the *Communicações da Direcção dos Trabalhos geologicos de Portugal* affords a good opportunity of recapitulating what has been accomplished in that country.

It is impossible to look at this and the other publications of the Portuguese Survey without a word of praise for the beauty of the plates with which they are illustrated, and the admirable way in which they are printed. It is a painful reflection to an English geologist that the inimitable work of our own Geological Survey should be presented to the world in a style so far inferior; and that the enlightened Government of a great empire should in this respect be so far behind that of a small and not very wealthy country like Portugal.

We may, however, be allowed to express our regret that so few of the memoirs of the Portuguese Survey are accompanied by maps, for without a map it is extremely difficult to follow the text of a stratigraphical paper; and without making a map it is, or should be, almost impossible for the worker himself to be sure that his views are correct. We regret too the long delay in the publication of a new edition of the general geological map of Portugal. Delgado is twenty years old, and although later information is elsewhere available, it is surely time that the Geological Survey

should take upon itself the production of a map more in accordance with modern needs.

By far the greater part of Portugal is occupied by ancient rocks of Archæan and Palæozoic age, and by eruptive masses which probably belong to various periods. All the higher mountains are formed of such rocks; and it is only in the plain of the Tagus and along the coasts that any later beds are to be found. The most extensive area of Mesozoic rocks forms a broken triangle with its base parallel to the Tagus between Lisbon and Torres Novas, and its apex at Oporto. Mesozoic rocks also occupy a narrow strip of country along the southern shores of Portugal in the province of Algarve. They are found too in the Serra da Arrabida, which forms the prominent cape south of Lisbon; and at São Thiago de Cacem and Cabo de Sines farther south. The largest area of Tertiary deposits is that which forms the plain watered by the Tagus and its tributaries.

"Azoic" Rocks.—The so called Azoic rocks, in which no fossils have hitherto been discovered and which are presumed to be older than the Cambrian, are best developed east of the Tertiary basin of the Tagus in the province of Alemtejo. But it cannot be said that their age has been determined with certainty, and the supposed absence of of fossils may be due to imperfect examination.

Lower Palæozoic.—In spite of the extensive area occupied by schists and other rocks of supposed Palæozoic age undoubted Cambrian fossils have been found at only a single locality in Portugal. So long ago as 1876, between the "Azoic" rocks of Alemtejo and the Lower Carboniferous of the borders of Algarve, Delgado recognised a series of beds which he believed to be distinct from both; and in this series, near the mines of San Domingos, were found *Nereites* and other forms which are usually believed to be tracks of animals. They are quite insufficient to determine the age of the beds, and it was chiefly from a lithological resemblance to certain rocks in the North of Portugal that Delgado referred them to the Cambrian (15).

More recently (21), however, trilobites have been discovered near Villa Boim, some 10 km. west of Elvas; and

these trilobites appear to belong to the characteristic Cambrian families *Olenidæ* and *Conocephalidæ*. Delgado, indeed, compares them with the genera *Liostracus* and *Leptoplastus*; but unfortunately no figures have yet been published, and all that the descriptions enable us to say is that they probably belong to the *Olenus* group. This discovery is of great interest, for at one time it was believed that the *Olenus* fauna was absent in Southern Europe. Recently, however, it has been found also in Sardinia.

The Ordovician and Silurian rocks are much better developed than the Cambrian, or at least they have been far longer known and have yielded fossils much more abundantly. One of the best known localities is that of Vallongo, 10 km. E.N.E. of Oporto, where Sharpe obtained a number of Ordovician fossils which were described by himself and others (41). Recently, Delgado has published a new list of the forms from this neighbourhood, and he recognises three distinct horizons (19). But there is some confusion in the identification either of the horizons or of the fossils; for from the third horizon he records, for example, both the Lower Ordovician form *Acidaspis Buchi* and the Silurian species, *Phacops Downingiæ*. Most of the Vallongo specimens are certainly Ordovician, and among them are *Placoparia*, *Calymene*, *Tristani* and others, characteristic of the Angers slates of France.

At Bussaco, some 20 km. north of Coimbra, Silurian fossils, as well as Ordovician, are found in some abundance. The Ordovician beds consist of a lower division of quartzites, sandstones, black shales and limestones, with *Calymene Tristani*, *Placoparia Zippei*, etc.; and these are succeeded by ochreous argillaceous rocks with *Phacops Dujardini*, etc. The Silurian is represented by blue shales and argillaceous schists with graptolites, *Cardiola interrupta*, and the thin-shelled Orthoceratites which Forbes called *Creseis* (38). Such forms are characteristic of our Lower Ludlow, and to a certain extent of our Wenlock beds.

South of the Tagus, in the neighbourhood of the granitic mass of Portalegre, Delgado has reported the presence of Ordovician beds (15). They commence with a series of

quartzites containing numerous "bilobites," similar to those which in the North of Portugal, and in parts of France, are found at the base of the Ordovician system. It is unnecessary here to enter into the controversy concerning these forms. Nathorst has given strong reasons for believing them to be the tracks of animals; but Delgado strongly opposes this view and maintains them to be algæ (16).

In the neighbourhood of Portalegre there is found also a small patch of schists containing *Monograptus* and some casts of bivalves (15). The relations of these to the surrounding beds are unknown; but if the graptolites are correctly referred to the genus *Monograptus*, they must certainly belong to the Silurian.

So far then as they are known, the Lower Palæozoic rocks of Portugal do not favour very strongly the view that there was any very marked difference in Older Palæozoic times between the faunas of Northern and Southern Europe. Nevertheless, *Placoparia*, *Calymene Tristani*, and *Acidaspis Buchi*, which are characteristic fossils in France and the Spanish Peninsula, are by no means common in Britain, although they have been found there. In short, we have no sufficient data as yet to show how far the fauna of Southern Europe resembled or differed from that of the North.

Upper Palæozoic.—There is only one locality in the whole of Portugal where the Devonian has yet been recognised, and this is near the Ordovician quartzites of Portalegre. A band of schists was discovered by Delgado containing *Phacops latifrons*, *Cryphæus*, and broad-winged Spirifers (15).

The Lower Carboniferous on the other hand occupies a wide area in the South of Portugal, where it forms the greater part of the hilly region on the northern borders of the province of Algarve. Like all the other Palæozoic rocks of Portugal, they have never been studied in detail, but they consist of schists and grauwackés, without either quartzites or limestones, and they contain *Posidonomya* (like *Becheri* and *Pargai*), and *Goniatites* (*cf. crenistria*) (15). Hence it appears that the Lower Carboniferous

belongs to the "Culm" facies so widely developed in Central Europe.

The Upper Carboniferous is very restricted in extent, and its distribution bears no relation whatever to that of the Lower Carboniferous. From the character of the deposits, and the mode of their occurrence, there can be little doubt that the Upper Carboniferous of Portugal was laid down in comparatively small basins not unlike those of the Central Plateau of France. It invariably rests unconformably upon very much older beds, and consists very largely of coarse conglomerates.

The most extensive area is met with in the North of Portugal, where the coal measures form a band stretching from the sea-coast at Espozendo (North of Oporto) in a S.S.E. direction across the Douro as far as Pijao in the province of Beira (22). The coal of this band near Vallongo was taken by Sharpe to be of Silurian age (41).

Farther north there is another band some 22 km. long and 700 m. wide in the neighbourhood of Bussaco (38, 26); and lastly, South of the Tagus there is a very small patch at Moinho d'Ordem near Alcacer do Sal (28).

The fossil plants from these three basins have been described by several writers, and according to Gomes (22) they indicate that the deposits of all three are of the same age, *viz.*, that of our Coal Measures. But Wenceslau de Lima has recently revised the flora of Bussaco, and from various considerations, and especially from the presence of *Walchia* and *Callipteris*, he has been led to conclude that the coal bearing deposits of Bussaco belong to the Rothliegende, or to the passage beds between Carboniferous and Permian (26). He believes, however, that the coal of the other basins is of somewhat earlier date. It is remarkable that in the Bussaco beds a crustacean has been found which W. de Lima refers to the genus *Eurypterus* (27).

Trias.—The Palæozoic rocks of Portugal are uncomformably overlain by a series of red and white sandstones and conglomerates, to which Choffat has given the name of

"grès de Silves". North of the Tagus these sandstones form the eastern border of the Mesozoic area, stretching in a narrow band from Aveiro nearly to the town of Thomar. South of the Tagus the "grès de Silves" is met with at São Thiago de Cacem, at Carrapateira (N. of Cape St. Vincent), and again as a narrow band resting upon the Palæozoic rocks in the littoral region of the province of Algarve (9).

North of the Tagus the sandstones begin to alternate in the upper part of the series with dolomitic and argillaceous limestones, and these in turn are surmounted by dolomites without sandstone belonging to the Sinemurien (40). In the lower or sandy part of the series there are several beds which contain remains of plants. These have been examined by both Heer (23) and Saporta (40) and seem to indicate a Rhaetic or Infraliassic age.

The calcareous beds which occur higher up in the series are called the "beds of Pereiros". They often contain marine fossils, for the most part gastropods and lamellibranchs, which are believed by Choffat to belong to the Infralias.

In Algarve the general succession is very similar. The red sandstones of the lower part of the series have yielded no fossils. The dolomites of the upper part contain marine forms; and as in the north, the dolomites gradually increase at the expense of the sandstones. They are overlaid by marls, spotted with white, which often contain gypsum, but no fossils (9).

Jurassic.—Jurassic rocks are found in four separate areas, all of which are in the neighbourhood of the coast-line. They extend, with some interruptions, from Aveiro in the north of Portugal, to Cintra. They occur also in the Serra da Arrabida, which forms the promontory south of the Tagus which we call Cape Espichel. They are found in the next important Cape to the south, the Cabo de Sines; and lastly, they are extensively developed along the coast of the province of Algarve.

The system is divided by the Portuguese geologists into three stages, corresponding with the three divisions adopted in Central Europe and named in ascending order,

the Lias, Dogger, and Malm. There is, unfortunately, no general account of the whole; but Choffat has given us a brief description of the Jurassic of Algarve (9), and a fuller account of the Lias and Dogger (2) and of the lower part of the Malm (12) north of Lisbon.

The Lias and Dogger are almost entirely marine, and correspond very closely with the contemporaneous beds of Central Europe. Many of the northern zones have been recognised in Portugal and further research no doubt will reveal others. It may be noted here that Choffat includes the Callovian in the Dogger (5, 8).

The Malm, on the other hand, is a much less purely marine formation, and in places contains beds of lignite, which are sometimes, for example, at Cape Mondego, extensive enough to be worked. It differs considerably from that of Northern Europe, and is very variable in character. Everywhere, however, it may be divided into two stages, the Lusitanian below and the Neo-jurassic above.

North of the Tagus the Lusitanian as it exists in the country of Torres Vedras has been described by Choffat (12). This area includes the chain of Montejunto and the low-lying country limited on the east by the Tertiary basin of the Tagus and on the south by the Cretaceous rocks of the neighbourhood of Lisbon. The Lusitanian beds rest upon Callovian deposits with *Peltocerus athleta* and *Cosmocerus calloviense;* and they themselves consist chiefly of limestones in the lower part and of clays with banks of sandstone in the upper. The limestones contain various Ammonites, among them several Oxfordian forms; while in the clays are found numerous gastropods and lamellibranchs, which are mostly similar to those from the Sequanian or Astartian of the Jura.

Elsewhere, however, excepting in the eastern part of Algarve, the Oxfordian fauna has not been discovered, and the Sequanian rests directly upon the Callovian, but without any visible unconformity.

In the Montejunto country the passage between the Lusitanian and the succeeding Neo-jurassic beds is formed

by clays with *Lima alternicosta.* Sandstones alternate with these clays and in the succeeding beds become predominant. They extend up to, and include the representatives of the Portlandian.

South of the Tagus nearly the whole of the Malm, and indeed nearly the whole of the Jurassic, consists of limestones, dolomites and marly limestones, excepting in the uppermost part, where coarse conglomerates are sometimes found (9). But the various localities show very different developments. In the eastern part of Algarve the series is complete, but towards the west there are very considerable gaps in the succession. In Western Algarve and at Carrapateira the lower part of the Lusitanian is absent. During the Jurassic period, therefore, Eastern Algarve lay under moderately deep water throughout, while the rest of Portugal, with its shallow water and lignite deposits and its interrupted sequences, seems during the deposition of the Malm to have been in great part land and in part covered only by shallow water. Portugal in fact is an exception to the general rule which obtains through most of Europe, that the close of the Lias period was marked by a great extension of the ocean. Throughout Portugal the Lias is entirely marine; while the Malm is generally in part absent and in part shows numerous brackish and lacustrine deposits (40).

Cretaceous.—The Cretaceous deposits occupy even a smaller space than the Jurassic. They cover, however, a good deal of ground immediately north of Lisbon; and several patches are found within the Mesozoic area farther north; while Cretaceous beds are also known in the littoral region of Algarve.

Again M. Choffat is our chief authority. He has described in some detail the Cretaceous of Cintra, Bellas, and Lisbon (extending from Cabo da Roca to the Tagus) (4); the Cretaceous patches of Torres Vedras, Peniche, and Cercal farther north (11); and also the Cretaceous band in Algarve (9). As in the Cretaceous of Southern Europe generally, Rudistae are among the characteristic fossils, although the genus *Hippurites* itself appears to be absent.

Choffat divides the system into the following subdivisions (in ascending order):—

Infravalanginien.
Valanginien.
Hauterivien.
Urgonien.
Beds of Almargem.
Bellasien.
Cenomanian Limestone.

Most of these subdivisions are the same as those adopted in Southern France and bear the same names. The beds of Almargem represent the Aptian, and possibly the Albian, of northern geologists, while the Bellasien is in part, and perhaps entirely of Cenomanian age. The "Cenomanian Limestone" may possibly include the lowest part of the Turonian; but no higher beds of the Cretaceous are known.

The difficulties which have been encountered in the examination and correlation of the Cretaceous deposits of Portugal, were due to the rapid changes in lithological character which the beds undergo even in a very short distance. The result of this has been that different facies of the same horizon have often been described as different horizons.

These rapid lateral changes were due without doubt to the nearness of the Cretaceous coast-line. Even in the Upper Jurassic, as we have already seen, transported materials play a considerable part, and this is still more true of the Cretaceous. Coarse sandstones and conglomerates are here abundant.

There are only two districts, namely, the region of Cintra and Bellas and that of Eastern Algarve, where the base of the Cretaceous is represented by marine beds, and both these districts are near the present sea margin. Here the whole of the Cretaceous excepting the beds of Almargem consists of marly limestones with a marine fauna.

In the Cintra area, for example, the beds from the Infravalanginien to the Urgonien, and the Bellasien also, consist chiefly of marls and marly limestones. The beds of

Almargem consist of sandstones at the base and summit and limestones in the middle, the respective development of the sandstones and limestones varying greatly. The Cenomanian Limestone consists of compact limestones with some marly limestones and sometimes with beds of flint. They contain *Rudistes Sphaerulites*, etc.

In the country of Bellas, which lies only 5 km. farther east, sandstones are much more developed, and form not only the Aptian but also the whole of the Valanginian. Twenty kilometres north east of Bellas the sandstones invade all that lies below the Bellasien. This is the case also at Torres Vedras and Cercal; and farther north still, sandstones form nearly the whole of the Cretaceous.

As far north as Torres Vedras there is no gap between the Jurassic and Cretaceous; but beyond this point the base of the Cretaceous is absent, and the gap becomes greater as we proceed farther north.

In general the coarseness of the material diminishes towards the west; and from this and the other facts noticed we may conclude that in the region north of the Tagus, during the Cretaceous period land lay towards the north and east, and gradually sank, the sea attaining its greatest extension in Cenomanian times.

In the extreme east of Algarve the lower part of the Cretaceous (the Neocomian of many authors) is entirely marine. At S. João-da-Venda it is replaced by sandstones and conglomerates; while in Western Algarve it is entirely absent. Here again then, as in the Jurassic period, we find that land lay in Western Algarve during a considerable part of the time while the eastern part of the province was under the sea.

Since both the Cretaceous and Upper Jurassic of Portugal consist largely of shore deposits, it is not astonishing that numerous beds of lignite have been discovered in them, and that plants are very abundant. These have been described in detail by Saporta, who finds a gradual passage from the Jurassic to the Cretaceous flora without any sudden change such as is met with in other parts of Europe (40).

Tertiary.—Towards the close of the Cretaceous period there appear to have been considerable outbursts of basalt, which at their base are interstratified with marls containing a terrestrial fauna. They may, perhaps, be connected with the great outflows of North-western Europe; but they have not yet been properly examined, and up to the present their age remains uncertain.

The Tertiary beds which occupy so much of the plain of the Tagus and occur elsewhere in smaller patches have not attracted much attention from the Portuguese geologists, and little seems to have been written concerning them.

The more recent deposits, however, have been the subject of various papers (13, 33, 39, 43), and evidence has been brought forward showing the existence of prehistoric man (1, 10, 17, 34-37), and also, in the higher mountains, of the previous presence of glaciers (20, 44). Striated blocks and other evidences of glacial action have been discovered in the Serra d'Estrella.

"*Tiphonic*" *valleys.*—But perhaps the most interesting problems in the whole of Portuguese geology are those which concern the valleys called by Choffat "tiphonic" (3, 6). These are met with chiefly in the Mesozoic area North of the Tagus. In all cases there is a level floor bounded on several sides by hills of Jurassic rocks. The floor is formed of reddish marls, the "Marls of Dagorda," and sometimes upon it rise low ridges of dolomite. Choffat has shown that the dolomites contain fossils of the same age as the Beds of Pereiros (Infralias), and he believes the marls to belong to the same period. The marls *appear* to dip below the Jurassic beds which form the hills surrounding the valleys; but the lower beds of the Jurassic are always absent. The appearance of a conformable sequence is in fact merely deceptive and the valleys are bounded by faults, the floor of the valley being raised so that the Infralias of the floor abuts against the higher Jurassic beds of the surrounding hills.

Connected with these tiphonic areas are considerable outbursts of ophite and teschenite (3, 6, 30, 31), and Choffat has brought forward some evidence to show that

the eruptions and the formation of the valleys took place in the Tertiary period.

Eruptive Masses.—Mention has already been made of the basaltic eruptions which took place at the close of the Cretaceous period, and of the outbursts of ophite which are probably of somewhat later date. But it is probable, too, that some of the great masses of eruptive granite which are so prominent on the geological map of Portugal are at least as recent as these. Ribeiro had long maintained that the granite of Cintra was of Tertiary age, but he never published his evidence. Choffat has shown that this granite has sent out veins into the base of the Malm; and as the higher beds of the Malm and the whole of the Cretaceous, up to the top of the Cenomanian, follow upon these without any sign of disturbance, he holds that the granite cannot have been intruded until after the deposition of the whole series. It cannot therefore be older than Upper Cretaceous (7).

One of the most interesting of the eruptive masses of Portugal is that which forms the greater part of the Serra de Monchique. This consists chiefly of elæolite syenite, which seems to have forced its way into the Culm of this region without ever reaching the surface. The gradual cooling of this mass under great pressure has led to the formation of some interesting varieties of dyke rocks which have been described by various writers, and subsequent denudation has exposed the resulting igneous complex (24 and 25).

BIBLIOGRAPHY.[1]

(1) BEN-SAUDE, ALFREDO. Notice sur quelques objets préhistoriques du Portugal fabriqués en cuivre. *Commun. Comm. Trab. Geol.*, vol. ii., pp. 119-124, 1888-92.

(2) CHOFFAT, PAUL. Etude stratigraphique et paléontologique des terrains jurassiques du Portugal. Le Lias et le Dogger au nord du Tage. *Secção Trab. Geol.*, 1880.

[1] Many of the Portuguese memoirs are published both in French and Portuguese. Where a French translation exists, the French alone is quoted here. Purely palæontological works are not included except where it has been found necessary to refer to them.

(3) CHOFFAT, PAUL. Note préliminaire sur les vallées tiphoniques et les éruptions d'Ophite et de Teschenite en Portugal. *Bull. Soc. Géol. France*, ser. 3, vol. x., pp. 267-288, 1882.

(4) CHOFFAT, PAUL. Recueil de monographies stratigraphiques sur le système crétacique du Portugal. Première étude; Contrée de Cintra, de Bellas et de Lisbonne. *Secção. Trab. Geol.*, 1885.

(5) CHOFFAT, PAUL. De l'impossibilité de comprendre le Callovien dans le Jurassique supérieur. *Commun. Comm. Trab. Geol.*, vol. i., pp. 69-87, 1883-87.

(6) CHOFFAT PAUL. Nouvelles données sur les vallées tiphoniques et sur les éruptions d'ophite et de teschénite en Portugal. *Ibid.*, pp. 113-122.

(7) CHOFFAT, PAUL. Age du granite de Cintra. *Ibid.*, pp. 155-157.

(8) CHOFFAT, PAUL. Sur la place à assigner au Callovien. *Ibid.*, pp. 159-163.

(9) CHOFFAT, PAUL. Recherches sur les terrains secondaires au sud du Sado. *Ibid.*, pp. 222-312, 2 pls.

(10) CHOFFAT, PAUL. Sur une station préhistorique à Obidos et sur la dispersion de l'Ostrea edulis aux temps préhistoriques *Commun. Comm. Trab. Geol.*, vol. ii., pp. 158-160, 1888-92.

(11) CHOFFAT, PAUL. Note sur le crétacique des environs de Torres Vedras, de Peniche et de Cercal. *Ibid.*, pp. 171-215.

(12) CHOFFAT, PAUL. Ammonites du Lusitanien de la Contrée de Torres Vedras. *Direc. Trab. Geol. Port.*, 1893.

(13) CHOFFAT, PAUL. Note sur les tufs de Condeixa et la découverte de l'hippopotame en Portugal. *Commun. Dir. Trab. Geol.*, vol. iii., pp. 1-12, 1 pl., 1895-96.

(14) CHOFFAT, PAUL. Notes sur l'érosion en Portugal. *Ibid.*, pp. 17-22, 4 pls.

(15) DELGADO, J. F. N. Sur l'existence du terrain silurien dans le Baixo-Alemtejo. *Secção Trab. Geol.*, 1876.

(16) DELGADO, J. F. N. Etude sur les Bilolites et autres fossiles des quartzites de la base du système silurique du Portugal. *Secção Trab. Geol.*, 1886. Supplément, 1887.

(17) DELGADO, J. F. N. Reconhecimento scientifico dos Jazigos de Marmore e de Alabastro de Santo Adrião e das Grutas comprehendidas nos mesmos jazigos. *Commun. Comm. Geol. Trab.*, vol. ii., pp. 46-56, 4 pls., 1888-92.

(18) DELGADO, J. F. N. Contributions à l'étude des terrains anciens du Portugal. *Ibid.*, pp. 216-228, 3 pls.

(19) DELGADO, J. F. N. Description d'une forme nouvelle de trilobite Lichas (Uralichas) Ribeiroi. *Comm. Trab. Géol.*, 1892.

(20) DELGADO, J. F. N. Note sur l'existence d'anciens glaciers dans la vallée du Mondégo. *Commun. Dir. Trab. Géol.*, vol. iii., pp. 55-82, 2 pls., 1895-96.

(21) DELGADO, J. F. N. Sur l'existence de la faune primordiale dans le Alto Alemtejo. *Ibid.*, pp. 97-103.

(22) GOMES, BERNARDINO ANTONIO. Flore fossile du terrain carbonifère des environs du Porto, Serra do Bussaco, et Moinho d'Ordem près d'Alcacer do Sal. *Comm. Geol. Port.*, 1865.

(23) HEER, OSWALD. Contributions à la flore fossile du Portugal. *Secção Trab. Geol. Port.*, 1881.

(24) HUNTER, M. and H. ROSENBUSCH. Ueber Monchiquit, ein camptonitisches Ganggestein aus der Gefolgschaft der Eläolithsyenit. *Tscherm, miner. petro. Mitt.*, N.F., vol. xi., pp. 445-466, 1890.

(25) KRAATZ-KOSCHLAU, K. V. Der geologische Bau der Serra de Monchique in der Provinz Algarve (Süd-Portugal). *Verh. natur.-medic. Vereins zu Heidelberg*, N.F., vol. v., pp. 215-225, 1894.

(26) LIMA, WENCESLAU DE. Noticia sobre as camadas da serie permo-carbonica do Bussaco. *Commun. Comm. Trab. Geol.*, vol. ii., pp. 129-152, 1 pl., 1888-92.

(27) LIMA, WENCESLAU DE. Note sur un nouvel Eurypterus du Rothliegendes de Bussaco (Portugal). *Ibid.*, pp. 154-157, 1 pl.

(28) LIMA, WENCESLAU DE. Estudo sobre o carbonico do Alemtejo. *Commun. Dir. Trab. Geol.*, vol. iii., pp. 34-54, 1 pl., 1895-96.

(29) LIMA, WENCESLAU DE. Notice sur une algue paléozoique. *Ibid.*, pp. 92-96, 4 pls.

(30) MACPHERSON, J. Résumé d'une Description des roches mentionnées dans la Notice précédente [Choffat, 3] *Bull. Soc. Géol. France*, ser. 3, vol. x., pp. 289-295, 1882.

(31) MACPHERSON, D. J. Estudo petrographico das ophites e teschenites de Portugal. *Commun. Comm. Trab. Geol. Port.*, vol i., pp. 89-112, 1883-87.

(32) MACPHERSON, J. Étude des roches éruptives recueillies par M. Choffat dans les affleurements secondaires au sud du Sado. *Ibid.*, pp. 313-332.

(33) MAGALHÃES MESQUITA, EGBERTO DE. Apontamentes ácerca da região littoral comprehendida entre as lagoas de Mira e de Esmoriz (dunas d'Aveiro). *Commun. Dir. Trab Geol.*, vol. iii., pp. 23-33, 1895-96.

(34) PAULA E OLIVEIRA, F. Note sur les ossements humains existants dans le musée de la Commission des Travaux géologiques. *Commun. Comm. Trab. Geol.*, vol. ii., pp. 1-13, pt. i., 1888-92.

(35) PAULA OLIVEIRA, FRANCISCO DE. Nouvelles fouilles faites dans les Kioekkenmoeddings de la vallée du Tage. *Ibid.*, pp. 57-81.

(36) PAULA E OLIVEIRA, FRANCISCO DE. Antiquités préhistorques et romaines des environs de Cascaes. *Ibid.*, pp. 82-108, 3 pls.

(37) PAULA E OLIVEIRA, FRANCISCO DE. Caracteres descriptivos dos craneos da Cesareda. *Ibid.*, pp. 109-118.

(38) RIBEIRO, CARLOS. On the Carboniferous and Silurian Formations of the neighbourhood of Bussaco in Portugal. With Notes and a Description of the Animal Remains, by DANIEL SHARPE, J. W. SALTER, and T. RUPERT JONES; and an account of the Vegetable Remains, by CHARLES J. F. BUNBURY. *Quart. Journ. Geol. Soc.*, vol. ix., pp. 135-161, pls. vii.-ix., 1853.

(39) RIBEIRO, CARLOS. Description du terrain quaternaire des bassins du Tage et du Sado. *Comm. Geol. Port.*, 1866.

(40) SAPORTA, LE MARQUIS DE. Nouvelles contributions à la flore mésozoique—accompagnées d'une notice stratigraphique, par PAUL CHOFFAT. *Direc. Trab. Geol. Port.*, 1894.

(41) SHARPE, DANIEL. On the Geology of the neighbourhood of Oporto, including the Silurian Coal and Slates of Vallongo. *Quart. Journ. Geol. Soc.*, vol. v., pp. 142-153, pl. vi., 1849.

(42) SHARPE, DANIEL. On the Secondary District of Portugal which lies on the North of the Tagus. *Quart. Journ. Geol. Soc.*, vol. vi., pp. 135-201, pls. xiv.-xxvi., 1850.

(43) VASCONCELLOS PEREIRA CABRAL, FREDERICO A. DE. Estudo de depositos superficicaes da bacia do Douro. *Secção Trab. Geol.*, 1881.

(44) VASCONCELLOS PEREIRA CABRAL, FRED. A. DE. Traces d'actions glaciaires dans la Serra d'Estrella, Roches striées, blocs erratiques, moraines. *Commun. Comm. Trab. Geol.*, vol. i., pp. 189-210, 4 pls., 1883-87.

PHILIP LAKE.

IODINE IN THE ANIMAL ORGANISM.

THE disease called Myxœdema is due to morbid conditions of the thyroid gland in which it no longer exercises its normal *rôle* in the metabolic cycle. It is now a matter of common knowledge that injection of extracts from the thyroids of other animals cures the disease, by replacing the lost internal secretion of the diseased or absent gland. This very remarkable practical outcome of physiological research has prompted several investigators to attempt the discovery of the active chemical substance secreted by the thyroid by which that organ normally influences the nutrition of the nervous system, and to which thyroid extracts owe their efficacy. Though this search can hardly yet be said to have completely attained its object many interesting facts have come to light during its progress, and by no means the least of these is the discovery that there are certain substances in the thyroid which contain iodine in organic combination; as an integral part of living animal structures this element was previously not known to exist.

The work was carried out in Baumann's laboratory at Freiburg, and began with an investigation by Ernst Roos[1] on the influence of the thyroid gland on metabolism. In Roos' paper the history of the subject, so far as it relates to the use of thyroid extracts in the relief of myxœdematous conditions is fully given. The experimental part of the paper describes observations on human beings during treatment, who showed a marked increase in the amount of phosphoric acid which they excreted. The majority of the experiments were, however, performed on dogs; the thyroid had been previously removed, and the gland was administered as food to them. The excreta were analysed and compared with those in healthy dogs. In the latter there is an increase in the excretion of nitrogen (more than can be explained by the nitrogen in the gland given) of sodium

[1] *Zeitsch. f. physiol. Chem.*, xxi., p. 19, 1895.

chloride and phosphoric acid. The rise in sodium chloride does not last as long as the others.

In dogs without a thyroid, the increased excretion of nitrogen and chlorine is even more marked, while that of phosphoric acid is not so great as in healthy animals. There is also a diuretic action.

Some attempts were made to separate and identify the active substance of the thyroid, but this part of the research was incomplete. So far as the experiments went they showed that the material is very stable; this was previously known because good effects follow thyroid feeding; the substance is therefore one which is not altered to any extent by digestive processes. The substance is probably proteid-like in nature, though not an enzyme as Notkin[1] considers.

This conclusion fits in very well with some previous work done by Gourlay.[2] Gourlay separated a nucleo-proteid and an albumin from the thyroid; he further discovered that the colloid matter in the thyroid vesicles is nucleo-proteid and if this passes into the lymphatics, as some have described, he thought it possible that the nucleo-proteid was the active agent. This contains nuclein, a substance not affected by gastric digestion.

Later Frankel[3] separated from the thyroid a crystalline material which he named thyreo-antitoxin; this has the formula $C_6H_{11}N_3O_5$; the evidence that this is really what its name signifies cannot, however, be described as satisfactory.

E Baumann[4] continued the search, and it was here that he came across the substance he called thyro-iodin, which is remarkable among animal products in containing iodine. The glands were boiled for days with ten per cent. sulphuric acid; the liquid after cooling deposited a glocculent precipitate, which after extraction with alcohol is the substance in question. It contains 9·3 per cent. of iodine, and it may

[1] *Wiener med. Wochensch.*, No. 19 and 20, 1895. Notkin named the enzyme he supposed to be the active agent—thyreo-proteid.

[2] *Journ. of Physiol.* xvi., p. 23. [3] *Wiener med. Blätter*, No. 48, 1895.

[4] *Zeit. physiol. Chem.*, xxi., p. 319, 1895.

be a derivation of nucleic acid as it contains 0·54 per cent. of phosphorus, but it was not obtainable from the thymus gland,[1] nor from pure nucleic acid.

From the first Baumann was inclined to the belief that here was the active substance he was looking for; this opinion was, however, expressed with considerable reserve until he had thoroughly tested the hypothesis by experiment; and in this part of the investigation he worked with Roos.[2]

They separated the substance by the use of either sulphuric or hydrochloric (10 per cent.) acid. It is insoluble in these reagents, the other constituents of the gland being soluble. It is thus extremely stable, and is moreover not altered by heat.

In the gland itself, thyro-iodin is, however, chiefly in combination with the proteids. They found that the proteids of the gland which can be dissolved out by saline solution are an albumin and a globulin.[3] It is with the albumin[4] that the greater part of the thyro-iodin is combined; the globulin contains a small quantity, and a third portion is free, that is, not combined with proteid matter at all.

The following table gives some idea of the quantity of iodine in the glands in human individuals.

			Dry weight of Organ.	Iodine in 1 gr. of Organ.
Adult human thyroids—Average of	26 cases.	Freiburg	8·2 gr.	0·33
" " "	30 "	Hamburg	4·6	0·83
" " "	11 "	Berlin	7·4	0·9
Children's thyroids "	39 "			0 or traces

[1] Later (Baumann, *ibid.*, xxii., p. 1, 1896) small quantities were obtained from calf's thymus.

[2] *Zeit. physiol. Chem.*, xxi. 481.

[3] For other work in the proteids of the thyroid see Gourlay, *loc. cit.*; Notkin, *loc. cit.*; Bubnow, *Zeit. physiol. Chem.*, viii., p. 1. The last observer found three proteids, one a globulin.

[4] Query, Nucleo-albumin, W. D. H.

In the sheep's thyroid, the percentage of iodine varies from 0·9 to 1·5 in the dry, and from 0·26 to 0·44 in the fresh organ.

In dog's thyroid little or no iodine is found; but the amount is increased by feeding on dog-biscuit. This fact together with the almost complete absence of iodine in the thyroids of children makes an impartial onlooker rather sceptical concerning thyro-iodin as the essential chemical substance in the internal secretion of the thyroid.

Nevertheless Roos[1] maintains, and supports his contention with numerous and exhaustive clinical records, that this substance acts both in men and animals just like thyroid extracts, or feeding on the gland. The resemblance is seen in its action on the general system, in metabolic processes, and in cases of disease (myxœdema and psoriasis).

Other observers have not been so fortunate. Thus Gottlieb[2] found in dogs after thyroidectomy that the administration of thyro-iodin had no influence in preventing the symptoms (convulsions, etc.) that follow this operation, nor in delaying death.

Auerbach[3] suggests that this is because Gottlieb's preparations were poor ones; they only contained 2·8 per cent. of iodine.

The main practical question is therefore unsettled, and must be left to future investigations to decide.

But as a point of scientific interest, the discovery of iodine in the animal body remains as one of great importance, and is the most startling of scientific discoveries made of recent years in the domain of chemical physiology.

Iodine in the thyroid is, however, not a unique occurrence. Almost simultaneously with Baumann's announcement, Drechsel[4] published a paper in which he showed that iodine occurs in other structures in quite a different part of the animal kingdom.

[1] *Zeit. physiol. Chem.*, xxii. p. 18, 1896.
[2] *Deutsch. med. Wochenschr.* xxii., 15, p. 235.
[3] *Centralbl. f. physiol.*, x., p. 133, 1896.
[4] *Zeit. f. Biol.*, xxxiii., p. 85, 1896.

The substance (*gorgonin*) of the horny skeleton of *Gorgonia cavolinii* contains iodine in organic combination. Gorgonin yields a decomposition with barium hydroxide an amido-acid containing iodine (*iodo-gorgonic acid* $C_4H_8NIO_2$) which is crystalline, and has the composition of a iodo-amido-butyric acid; its constitution is, however, not yet certain.

The living substance of the gorgonia contains no iodine or only the merest traces; it is of proteid nature and on decomposition with hydrochloric acid yields, lysine and probably lysatine.[1]

Gorgonin is also a proteid, it yields on decomposition with hydrochloric acid, leucine, tyrosine, lysine, lysatine (?), iodo-gorgonic acid and ammonia.

W. D. HALLIBURTON.

[1] According to Hedin's recent work (*Zeit. physiol. Chem.*, xx., 186; xxi., 155, 297), lysatine is a mixture of lysine and arginine. Arginine ($C_6H_{14}N_4O_2$) is a base originally separated from vegetable tissues by Schulze and Steiger (*ibid.*, xi., 43; *Ber. d. deutsch. Chem. Ges.*, xxiv., 2701), and subsequently found by Hedin to be a constant decomposition product of proteids and albuminoids. It yields urea on treating its silver salt with barium hydroxide.

PETROLOGY IN AMERICA.

THE material for study offered to the American geologist is rich in many respects, and perhaps in no branch richer than in petrology. The vast tracts of Tertiary lavas along and to the west of the Rocky Mountains, the peculiar igneous rocks on the east side of the great watershed, the varied series of lavas, tuffs, and intrusive masses in the Palæozoic and older formations of the Eastern states, the extensive areas of igneous and other crystalline rocks in the Lake Superior region, the Adirondacks, Canada, etc., all present many points of interest, and much valuable work has already been done in the description and study of these rocks. These results we owe in large part to the United States Geological Survey and that of Canada, and to various state surveys: Minnesota, New York, Arkansas, Texas, etc. Besides this official work, systematic petrographic research has been carried on at several universities and colleges, such as Johns Hopkins, Columbia College, Yale, the University of California, and others. It is proposed in this paper to notice a few of the more interesting contributions from American sources during the last two or three years; but in selecting from so large and varied a literature we are compelled to confine ourselves to certain areas and certain groups of rocks.

Among the older formations much attention has been given to the massive basic igneous rocks so extensively developed in some parts of Canada and the United States. Adams (1) has given us a very complete account of the so-called "anorthosites" or felspar-rocks which constitute the chief bulk of what has been named the Norian formation of Canada. They are undoubtedly plutonic rocks of the gabbro family, characterised, however, by a great preponderance of plagioclase felspar, usually labradorite. Next in importance, though much subordinate, to the felspar are augite and hypersthene, or in the Saguenay district olivine.

An original parallel-structure or banding is found in some of the rocks, and cataclastic structures are frequent. When iron-ore is present, it is always highly titaniferous, and in places there are in the anorthosite masses of ilmenite with only subordinate olivine and plagioclase.

The similar and perhaps coëval rocks of the Lake Superior region have been investigated by Lawson (2) on the Minnesota coast. They are fresh, coarse-textured, massive rocks composed almost wholly of felspar. This has been stated by Winchell to be labradorite, while Irving described it as anorthite. Lawson finds both these varieties in the rocks of different localities. The only other constituent present is a little augite, partly in grains, partly in minute parallel inclusions in the felspar, and the rocks are thus of remarkably simple mineralogical constitution.

Bayley has undertaken a general study of the basic massive rocks of the Lake Superior region (3). The most important instalment of his results deals with the great gabbro mass at the base of the Keweenaw formation in North-eastern Minnesota. This has sometimes been regarded as a "flow," but he suggests that it is either a great intrusion in the lower part of the Keweenaw or an older eroded massive rock, upon which the latter has been deposited. As the rock has the characteristic structure of a plutonic mass, it is indeed difficult to believe that it can have consolidated under superficial conditions. Its constituent minerals are felspar, augite, olivine, and magnetite, and variations in the relative proportions of these give rise to different types, very rich in one or other of these constituents. A point of some theoretical importance is that these constituents seem to be the same in rocks which differ widely in total composition. The felspar is always a basic labradorite ; the olivine is a hyalosoderite with 34 per cent. of ferrous oxide ; the magnetite is not titaniferous in the normal rock, and the aggregates of titaniferous iron-ore well known in Minnesota belong to rocks differing in various respects from the great mass.

Near the base of the main mass of gabbro, along its northern edge, occur a number of partially banded rocks of

more basic nature, which the author ascribes to processes of differentiation in the gabro-magma during its cooling. These include various peridotites and pyroxenites, or as Bayley names them, to mark their affinities, " non-felspathic gabbros ". There are olivine-pyroxene rocks, varying to pureolivine-rocks; pyroxene-aggregates; pyroxene-magnetite rocks; and rocks containing up to 90 per cent. of titaniferous magnetite. Analyses of this magnetite have yielded from 2 to 16 per cent. of titanic acid. Associated with these various basic modifications of the gabbro are rocks differing from the normal gabbro in possessing the granulitic structure. They differ also to some extent in mineralogical constitution, hypersthene largely taking the place of the olivine, while the augite is more or less replaced by biotite and hornblende.

It is well known that rocks of the gabbro family, closely comparable with those of Canada and of the Lake Superior region, are largely developed in the Adirondacks, in the northern part of the state of New York. A large part of these rocks are "anorthosites," composed mainly of labradorite felspar with only subordinate augite and hornblende and usually some red garnet, perhaps secondary. The rocks are much affected by cataclastic structures. These anorthosites form the heart of the mountain region, while more basic gabbros constitute the smaller outlying intrusions and minor portions of the main ridges. The latter rocks have been described by Kemp, as they occur on the eastern side of the mountains, along the western shore of Lake Champlain (4). The felspar seems as before to be labradorite: the other minerals are augite, hypersthene, titaniferous magnetite, and occasionally olivine. In places there are bodies of iron-ore with 13 to 16 per cent. of titanic acid, and these are regarded as representing an extremely basic phase of the gabbro magma itself.

These iron-ores are described in more detail by the same author in a bulletin dealing with the geology of two townships in Essex County, N.Y. (5). The ores are all essentially of magnetite, but those of Westport township are of little value on account of the considerable amount of

titanic acid which they contain, while those of Moriah are practically free from that substance. The titaniferous ores occur in the gabbro, the non-titaniferous in the gneiss of the district. In Canada, Lawson has pointed out exactly the same distinction between the magnetite, whether disseminated or collected in rich bodies, of the gabbros and anorthosites and of the gneiss, respectively.

Smyth (6) has given an account of the different varieties of gabbro in the north-western part of the Adirondacks. One kind consists mainly of felspar and augite, the latter often converted into compact hornblende, but the relative proportions of these constituents vary greatly. The commonest type is very rich in the ferro-magnesian minerals, but there are rapid transitions into a highly felspathic rock. The felspar is in general labradorite, but in the more felspathic varieties of the rock it is a more acid species, with perhaps some orthoclase. Another type of gabbro is hypersthene-bearing. The most interesting, however, is a rock consisting of dominant felspar, with some augite, etc., and showing cataclastic structures. The felspar ranges from a highly twinned plagioclase to a fibrous microperthite, and from a petrographic point of view the rock shows transitions from a gabbro or anorthosite to an augite-syenite. The latter has $65\frac{1}{2}$ per cent. of silica, and about 5 per cent. each of potash and soda. In contrast with the Minnesota gabbro, we notice here that, as the rock varies, the minerals (at least the felspars) vary with it, indicating clearly that the differentiation has here been effected prior to the crystallisation of those minerals.

Without citing other papers on the gabbros and allied rocks of the North American continent, we may briefly advert to two or three points of general interest brought out in the works summarised above. One question of considerable petrological importance relates to the so-called "reaction-rims" which often surround the crystals of certain minerals. These consist of one or more zones of various silicates, etc., interposed usually between some ferro-magnesian mineral and the plagioclase felspar. The phenomenon is common in other districts of America and

Europe. The name applied to it assumes that the bordering minerals are of secondary origin, due to reactions between the felspar and the ferro-magnesian silicate or iron-ore grain, and several writers have ascribed the effect to dynamic metamorphism ; but on these questions there is by no means a common agreement. In the Canadian anorthosites Adams (1) records a zone of red garnet as frequently occurring between pyroxene or iron-ore grains and felspar. In other cases he notes two zones between olivine and felspar, the first being of a pale rhombic pyroxene, the second of pale green actinolite needles, set perpendicularly and sometimes having parallel interpositions of deep green spinel. He finds no evidence of these rims being a secondary effect due to dynamic causes. In the great gabbro mass in Minnesota, as described by Bayley (3, 7), the olivine is often surrounded by a narrow border of diallage or augite which thus intervenes between it and the felspar. This border seems to be certainly an original growth, for it is sometimes seen to be continuous with a crystal-plate of diallage. Elsewhere there is a fibrous intergrowth of the bordering augite with the contiguous labradorite, and this is found surrounding magnetite as well as olivine. Biotite is also found interposed between magnetite and plagioclase, and this Bayley considers due to a reaction, but his reasoning is scarcely convincing. In the anorthosites of the Adirondacks Kemp states that there are no reaction-rims, although the rocks give evidence of great dynamic disturbance. In the basic gabbros, however, he describes a considerable variety of borders round pyroxene, olivine, and magnetite. Between augite and felspar is interposed a zone of brown hornblende crystals; between magnetite and felspar a first zone of brown hornblende and a second of garnet. In this latter case there may be additional zones, such as biotite immediately surrounding the magnetite, or clear quartz between the hornblende and the garnet. A curious feature is a parallel or micrographic intergrowth of the garnet with the adjacent felspar. Between olivine and felspar are seen in some cases three successive zones, respectively of granular

hypersthene, quartz, and garnet; or again a zone of brown hornblende followed by one of garnet. While speaking doubtfully of the hornblende and biotite, Kemp considers the garnet certainly secondary on account of its peculiar relation to the felspar. The quartz he regards as the residual silica liberated in the conversion of labradorite to garnet. In view of the great variety of micrographic intergrowths known to occur as original products in various igneous rocks, the secondary origin even of the garnet in this case seems to be by no means conclusively established. The hypothesis of secondary reactions is confronted in some cases by chemical difficulties; thus, it is not easy to see how brown hornblende can be produced by reactions between augite and labradorite, or biotite from magnetite and labradorite. It is, however, true in a general sense, as has often been pointed out, that the rims are usually more or less intermediate in chemical composition between the minerals which they separate. Allowing due weight to this fact, it is still to be observed that the succession of zones is in general what would be expected if the minerals had crystallised out from a molten rock-magma, following the normal order of consolidation of the several minerals as laid down by Rosenbusch. It is also a common feature in undoubted products from igneous fusion that the earliest formed minerals tend to serve as a nucleus for the crystallisation of those that follow, and this is most noticeable in plutonic rocks of basic composition. Further the "celyphite" borders round garnets, and other similar phenomena, afford numerous examples of radiating fibrous arrangement, and linear parallel intergrowth of different minerals, which in many cases are, beyond reasonable doubt, of primary origin. It seems, therefore, that we must require more convincing proof before accepting the view that the "reaction-rims" in these gabbro-rocks are in general, or in any considerable part, really due to secondary reactions between the original constituent minerals.

Another interesting feature in these American gabbros is the occurrence in them of considerable bodies of iron-ore, which have clearly been secreted from the gabbro-magma

itself. Vogt has recognised among iron-ores thus connected with basic igneous rocks two chief types, one characterised by titaniferous iron-oxides, the other by nickeliferous iron-sulphides. Some of the former we have already referred to, but examples of the latter are also known in America, the case of Sudbury in Canada being cited by Vogt. Kemp (8) has recently described an occurrence in Pennsylvania, in which the relations are very clearly exhibited. The ore is associated with a dark basic rock, now consisting mainly of hornblende but probably an amphibolised norite or gabbro, which forms a lenticular mass some 500 yards long. The ore occurs as a marginal modification of this rock, and consists of nickeliferous pyrrhotine and copper pyrites with some iron pyrites and secondary millerite (nickel sulphide). These minerals are associated with a certain amount of hornblende in such a manner as to show that they must have been original constituents of the rock.

The Adirondack gabbros afford some fine examples of contact-metamorphism. The phenomena are most striking at the contact of the gabbros with the crystalline limestones of the district, and some well known-mineral localities fall under this head. As described by Smyth (6), the limestones become more coarsely crystalline as they approach the gabbro, and pass finally into a zone consisting of various lime-silicates and other special minerals, up to one or two feet in width. In one occurrence this zone consists of fibrous white wollastonite and grains of green pyroxene, with some sphene and garnet. At other localities there are several bands parallel to the junction, the one in contact with the intrusive rock being of wollastonite, the next a mixture of felspar, pyroxene, scapolite, sphene, zircon, etc., and then coarsely crystalline calcite with much pyroxene. Again, a layer of scapolite may occur in immediate contact with the gabbro. Another mineral recorded is orthoclase in well formed crystals, while phlogopite mica is generally distributed. The author considers that there must have been actual chemical reactions and interchange of material between the intruded magma and the limestone. The gabbro itself shows some modifications at the contact, the

chief mineralogical feature being the coming in of abundant little grains of sphene, which indeed seems to point to a local enrichment in lime. On the western shores of Lake Champlain, again, Kemp (4) describes the limestones as becoming coarsely crystalline near the gabbro and charged with bunches of various silicates and other minerals: quartz, plagioclase felspar, diopside, hornblende, scapolite, brown mica, pyrrhotite, tourmaline, sphene, etc. Scapolite is characteristic in this connection throughout the region, and is always accompanied by pyroxene and hornblende. Further details are given in a later paper (9). The crystalline limestones are associated with various gneissic and schistose rocks, doubtless also metamorphosed sediments, and in the upper part of the series come serpentinous limestones or ophicalcites. In the best sections, at Port Henry, the bunches or patches of silicate-minerals, etc., enclosed in the limestone range up to masses twenty-five to fifty feet thick. They consist generally of a coarsely crystalline aggregate of plagioclase, quartz, and hornblende, with various other minerals as mentioned above. The serpentine in the ophicalcites, as Merrill had already shown, has been mainly derived from pyroxene, but Kemp finds evidence that garnet has also furnished a part. The rocks also contain lenticular patches composed of pyroxene, hornblende, sphene, and phlogopite. These serpentinous rocks occur in the limestones on the west as well as on the east side of the Adirondacks.

Much attention has been given in recent years to the various igneous rock-types rich in alkalies which occur in the region east of the continental water-shed. A number of interesting examples have been described by Weed and Pirsson from the State of Montana. Two types of phonolitic dyke-rocks were first discovered as boulders, but subsequently traced to their sources in the Bear-Paw Mountains (10). One, styled pseudo-leucite sodalite tinguaite, is of interest especially as containing the pseudomorphs of orthoclase and nepheline after leucite already known in Brazil, Arkansas, etc., while fresh sodalite is also

very abundant. The other, described as quartz-tinguaite porphyry, corresponds very closely with Brögger's grorudite, differing chiefly in the presence of large porphyritic crystals of orthoclase. Besides a variety of intrusive rocks, there occur in the Bear Paw Mountains a series of basalts, probably leucitic, but of these no description has yet appeared.

In the Highwood Mountains (11) in central Montana similar basaltic tuffs and flows occur, while distinct volcanic cores are seen breaking through the level Cretaceous strata, which are further cut by a large number of dykes with a radial disposition. The most interesting feature, however, is the laccolitic intrusion which forms Square Butte, an isolated mountain some three or four miles in diameter, and rising about 2500 feet above the surrounding plateau. The laccolitic character of the mass is clearly demonstrated, and its structure has been laid bare by erosion. It consists of two types of rock, an inner portion of an acid felspathic type surrounded by a zone of a basic augitic one. The former is a sodalite-syenite consisting of sixty-six parts of felspar, twenty-three of hornblende, eight of sodalite, and three of analcime : it has already been described by Lindgren and Melville. The dark type is a syenitic rock, in that its dominant felspar is orthoclase, but it constitutes a peculiar basic variety to which the name shonkinite is given. Augite, containing 1 per cent. of soda, makes up about half the rock, olivine and iron-ore occur in smaller amounts, while apatite, sodalite, nepheline, etc., are accessories. Chemical analyses of the two rocks show a notable difference, the former being richer in silica, alumina and alkalies, the latter in iron-oxides, magnesia, and lime. Examination proves that they are parts of a single intrusive body of rock, though the transition from one to the other is a rapid one. The phenomena seem to show conclusively that the magma was injected in a homogenous condition, and was differentiated in place. That the differentiation was, at least in part, effected prior to crystallisation appears from the difference between the ferro-magnesian minerals of the two rocks.

The same authors have studied certain allied rocks occurring at Yogo Peak in the Little Belt Mountains, also in Central Montana (12). These rocks form parts of a mass two miles long and one mile wide occupying a great fracture in the Palæozoic strata. At the eastern point of the peak occurs a syenite with $61\frac{1}{2}$ per cent. of silica and moderately high percentages of magnesia and lime. It is an augite-syenite, though with subordinate hornblende. Westward it gradually changes character in the sense of becoming more basic, until at the summit it contains as much augite as orthoclase. This type, which has about $54\frac{1}{2}$ per cent. of silica, has been named yogoite. At the western point of the peak the augite predominates over the orthoclase, while biotite and iron-ore also become prominent, and pseudomorphs after olivine are sometimes found. The rock here is a shonkinite similar to that of Square Butte. The silica percentage has fallen to 49, while the amounts of iron-oxides, magnesia and lime have increased considerably as compared with those in the syenite. A still more basic type occurs in irregular masses at the contact. In Yogo Peak then we have an intrusive stock of oval form, which shows a progressive differentiation from east to west along its major axis. It may be remarked that, as the several associated rock-types are composed in general of the same minerals, the augite in particular running through all the varieties, the differentiation seems to have been of a kind which has elsewhere been considered to have been effected concurrently with, and as a consequence of, crystallisation. Another interesting point is the occurrence of shonkinite in association with two distinct types of syenite, the sodalite-syenite of Square Butte and the augite-syenite of Yogo Peak; illustrating the fact that a given rock-type may originate by differentiation in more than one way.

A series of specimens, chiefly from intrusive sheets, in the southern part of the same state have been described by Merrill (13), and some of them show evident affinities with the foregoing rocks. One type, described in several examples under the name augite-porphyrite, compares rather closely in chemical composition with the yogoite of

Weed and Pirsson, and seems to be the porphyritic or "dyke" equivalent of that plutonic rock. A rock with porphyritically developed olivine and augite has a peculiar composition. With 47 per cent. of silica it has as much as 21 per cent. of magnesia, and on the other hand 3 per cent. of alkalies, chiefly potash. Iddings has remarked that this rock falls under the type which he has named absarokite. The same remark applies to others from South Boulder, Antelope, and Cottonwood Creeks, which Merrill has described under the title of lamprophyres. These contain mica as well as olivine and augite, but, as before, no porphyritic felspar, while the analyses show that the felspar of the ground-mass is largely of a potash-bearing species.

In his *Origin of Igneous Rocks* (1892), Iddings drew attention to certain dykes and lava-flows of exceptional character occurring in the Absaroka Range in the Yellowstone Park region. These rocks belong to a late stage in the igneous activity of the district. While showing evident consanguinity with the more usual types with which they are associated, they have chemical and mineralogical peculiarities comparable with those of Merrill's rocks in the country farther north. In a later paper Iddings (14) has given a more complete account of these rocks, which constitute what Brögger styles a "rock-series," that is, a number of types representing like phases of differentiation from what may be regarded as the more normal series of basalts and andesites, with which they are associated. Iddings distinguishes three types, absarokite, shoshonite and banakite. They are usually porphyritic, the phenocrysts being of olivine and augite, with labradorite in the two latter types. The ground-mass is rich in alkali-felspars, and in some varieties contains leucite. In absarokite, which is the most basic type with 46 to 52 per cent. of silica, there is no porphyritic labradorite but only olivine and augite. In shoshonite, with a silica-percentage of 50 to 60, and comparatively rich in alkalies, labradorite figures among the porphyritic elements, and in banakite it predominates. In this type mica partly takes the place of augite in the ground-mass, and the rocks are highly felspathic. Silica ranges

from 51 to 61 per cent., and the alkalies jointly from $8\frac{1}{2}$ to 10 per cent., potash predominating. The most acid banakites carry a certain amount of quartz. We have thus a well-defined series of rocks which may be roughly described as alkali-basalts and alkali-andesites.

Passing southward we have next to notice another area of rocks rich in alkalies. Just as the Geological Survey of Arkansas gave us a valuable account of nepheline-bearing and allied rocks in that State, so the Texas Survey has discovered the existence of an extensive development of such rocks in Southern and Western Texas. Kemp in 1890 recorded a Cretaceous nepheline-basalt from Pilot Knob, near Austin, and since then a number of interesting rocks have been described by Osann. Three years ago he drew attention to two types occurring in Uvalde County in the southern part of the state (15). One, forming dykes, is a fresh rock named melilite-nepheline-basalt, the two minerals being present in about equal quantity. There are large crystals of olivine, and the ground-mass consists of augite, nepheline, melilite, magnetite, and perofskite. The other type, forming hills and buttes, is a nepheline-basanite, in which the porphyritic elements are hornblende, augite and nepheline, with some felspar and olivine. Since part of the felspar is a sanidine, and olivine is rare, the rocks approach phonolite in characters.

More recently the same geologist has described a varied group of rocks, plutonic, intrusive and volcanic, in and around the Apache Mountains in the western (trans-Pecos) portion of Texas (16). An elæolite-syenite occurs at Paisana Pass, and another in the Mount Ord Range, to the south-east of the Apaches. In both låvenite is a constant accessory mineral. The Mount Ord rock passes from a normal elæolite-syenite through a fine-grained porphyritic variety to a marginal phonolitic facies. The change of texture and structure is accompanied by mineralogical changes, the malacolite-like augite, hornblende, and mica giving place to ægirine-augite, ægirine, arfvedsonite, and ænigmatite. In the Saw-Tooth Mountains, in the western part of the district, occurs an augite-hornblende-syenite,

without elæolite, and this too passes at its margin into porphyritic varieties with fine-textured ground-mass. The special interest of these latter is that they are rhomb-porphyries, reproducing in the peculiar habit of their porphyritic felspars and in other respects the characteristics of the well-known rocks of the Christiania district. As in other districts of elæolite-syenites and augite-syenites, there are in the Apache Mountains region numerous dykes of tinguaite and bostonite, and to these two types Osann adds a third, more acid, to which he gives the name paisanite. This contains quartz, and has some resemblance to the grorudite of Brögger, but differs from it in having the soda-amphibole riebeckite instead of ægirine. Moreover this mineral occurs not in crystals but in fibrous and irregular patches in the ground-mass, a common character in the soda-bearing amphiboles of the whole group of rocks. The lava-flows of the district, besides basalt and rhyolite, include a type of phonolite which is distinguished by the name apachite. Its special characters are firstly the abundance of amphiboles in addition to augite and ægirine, and secondly the prevalence of microperthitic intergrowths in the felspars of the ground-mass. The amphibole minerals are a brown variety, apparently between arfvedsonite and barkevicite, and a blue one resembling that which Brögger has described in his grorudite dykes under the name cataforite. The age of these various eruptive rocks in Western Texas has not been determined further than that they are post-Carboniferous.

Before leaving the subject of nepheline or elæolite-syenites, we may note a new Canadian occurrence recently described by Adams (17). It occupies a large area among the Laurentian rocks at Dungannon, Ontario. Nepheline is by far the most abundant constituent, and one variety of the rock is composed almost wholly of this mineral with a little hornblende or mica, thus corresponding with the ijolite of Ramsay and Berghell from Finland. The felspathic constituent of the rock is albite to the exclusion of orthoclase, as in the occurrence at Litchfield, Maine, which Bayley has styled litchfieldite. The other minerals present

are either mica or hornblende in different examples, scapolite, calcite, a titaniferous garnet, and zircon, with sometimes sodalite, the last occurring in places in large masses. In the latter veins of orthoclase occur with the relations of a secondary product (18). The rock contains a variety of hornblende with very low axial angle. This yielded on analysis only 34 per cent. of silica, while the alkalies amounted to $5\frac{1}{2}$ per cent.

Rocks of this class are now known from a number of localities in Canada and the north-eastern United States, including Montreal, where the rocks are proved to be of Silurian age, Litchfield in Maine, Salem and Marblehead in Massachusetts, Beemerville in New Jersey, and Red Hill in New Hampshire. Special interest attaches to the numerous dykes within this large region, which are either known or inferred to stand in genetic relationship with the elæolite syenites. These rocks include on the one hand the highly felspathic type bostonite, and on the other hand the complementary products of differentiation represented by camptonite, monchiquite, ouachitite, fourchite, and other peculiar lamprophyric rocks. Rosenbusch founded his type camptonite on Hawes' rock from Campton Falls in New Hampshire. Other examples have been described by Harrington from Montreal, by Kemp and Marsters from the Forest of Dean in New York State, the Hudson River highlands, Whitehall also in New York, etc. From Andro scoggin County, Maine, Merrill (19) has described rocks which might be termed augite-camptonites, containing that mineral both in phenocrysts and in the ground-mass, as well as hornblende, but showing a tendency towards the ophitic structure which places them in an intermediate position between the lamprophyres and the diabases.

The elæolite-syenite of Beemerville was first recognised as such by Emerson, but Kemp (20) has added considerable information relative to its modifications and its attendant dykes. A porphyritic marginal facies of the main mass is of special interest since Brögger has taken it as the type of his sussexite, the basic end-member of his grorudite-sölvsbergite-tinguaite series. It contains 45 per

cent. of silica and 11 per cent. of soda, and consists of porphyritic crystals of nepheline up to an inch in diameter in a tinguaitic ground-mass rich in nepheline and ægirine. The associated basic dykes in this district are mostly rich in biotite, corresponding with the ouachitite of Arkansas and in some cases with the allied type fourchite.

The dykes of the Lake Champlain district in New York and Vermont were noticed by Kemp and Marsters in 1891, and more recently a Bulletin of the National Geological Survey has given a fuller account by the same writers (21). Besides bostonites and diabases, they describe typical camptonites with hornblende, augite-camptonites, monchiquites, and other rocks which from the absence of olivine are placed under fourchite. Near Danbyborough in Vermont, Marsters (22) has described a variety of camptonite differing from the Campton type in having no porphyritic hornblende. This mineral occurs in idiomorphic brown crystals in the ground-mass, while there are also two generations of augite and rather abundant biotite. From Lake Memphremagog, on the Canadian border of the same state, he has recorded (23) a number of lamprophyre dykes associated with dykes of granite, occasionally taking on the characters of bostonite. The prevalent type here is an augite-camptonite, in which both augite and hornblende occur in two generations. Hornblende-camptonite, monchiquite, and fourchite are represented by single dykes.

These various rocks, as will be noticed, do not contain any mineral of the "felspathoid" group (leucite, nepheline, sodalite, etc.). Kemp (24) has, however, drawn attention to a peculiar dyke occurring at Hamburg, N.J., at some distance from the Beemerville elæolite-syenite, and presenting mineralogically some resemblance to the rather ill-defined group of rocks named teschenites. The rock in question consists nainly of biotite and pyroxene set in an interstitial mass of analcime. It contains spheroidal bodies up to 10 mm. in diameter composed of analcime, apparently pseudomorphs after some vanished mineral. Hussak in 1892 had already taken these as indicating destroyed leucite, and Kemp has subsequently placed this beyond doubt by

finding fresher specimens in which some leucite still remains.

The presence of melilite in certain dykes in the region is another point of interest. Smyth in 1892 described a rock from Manheim, N.Y., under the name peridotite, as consisting of abundant olivine, biotite, magnetite, and perofskite, with considerable quantities of alteration-products. Later study of fresher material has enabled him to identify melilite as a constituent, and the rock becomes an alnöite or melilite-basalt (25). The melilite shows the characteristic "peg-structure," but differs optically from the mineral as usually known in having positive double refraction. An alnöite had already been described by Adams from Ste Anne de Bellevue near Montreal (26). Here the porphyritic elements are large crystals of brown mica (anomite), olivine (with conversion to hæmatite), and augite, and the ground-mass consists of the same minerals with melilite, magnetite, apatite, and perofskite, the rock agreeing very closely with that of Alnö, off the coast of Sweden.

Some other porphyritic dyke-rocks which have been called peridotites might perhaps be placed with more propriety under monchiquite as olivine-bearing lamprophyres. Darton and Kemp (27) have described such a rock from De Witt, near Syracuse, in the same district as the Manheim alnöite. It contains abundant olivine and porphyritic crystals of biotite and subordinate augite in an augitic ground-mass of the monchiquite type. The peridotite of Pike County, Arkansas, seems to be closely similar. Of the monchiquites and the typical fourchites and ouachitites of the last-named state it is not necessary to speak—we have referred to the work of the late J. F. Williams on a former occasion. Here, as elsewhere, these peculiar lamprophyre dykes figure as the satellites of plutonic rocks of the nepheline-syenite family, though some occur at considerable distances from any visible outcrop of the latter rocks. These Arkansas intrusions are assigned to an epoch about the close of the Cretaceous period.

We pass westward in our hasty survey to the Rocky Mountain region. Limitations of space compel us to omit

in the present communication any notice of the varied series of Tertiary effusive rocks, as we have already passed over the equally interesting ancient lavas and tuffs of the eastern states; and we go on to notice an important memoir by Whitman Cross (28) on a widely distributed type of intrusive rock. It was about twenty years ago that Peale, Holmes, and Gilbert investigated the nature of the large lenticular masses of igneous rocks which occur in various parts of the Rocky Mountains of Colorado, and have given rise to numerous isolated groups of mountains farther west, in Utah and Arizona. To intrusions of this form, uplifting the strata above them in the fashion of a dome, Gilbert gave the name laccolite, and the highly symmetrical examples described by him in the Henry Mountains in Utah have remained the type of this kind of occurrence. But little petrographical examination was made at that time of the rocks constituting these laccolites, which were generally referred to as trachytes. In 1887 Cross pointed out that this name was not well chosen, and that trachyte in the strict sense is certainly not a common rock-type in the region. In his recent paper, besides adding considerably to our knowledge of the nature of these laccolitic intrusions and the varieties of form which they take on in different circumstances, he has given a very complete account of the rocks which compose them. The most striking feature of these rocks is their uniformity in chemical, mineralogical, and structural characters throughout a very extensive tract, prolonged northward apparently into the Yellowstone Park and perhaps into Montana. The analyses show variation between certain limits in silica-percentage and in some other particulars with a remarkable constancy in certain other features. The alkalies jointly are always about 6 or 7 per cent., potash and soda being in equal quantities in the rocks of Colorado, while the latter preponderates in those of the plateau groups to the west and in the Yellowstone district. All, or nearly all, the rocks are porphyritic, crystals of plagioclase felspar and ferro-magnesian silicates having been formed prior to the intrusion of the magma. Plagioclase is predominant and,

of the dark silicates, hornblende and biotite, hypersthene and augite, appearing only locally. Quartz also occurs, and in some cases very large crystals of orthoclase. The porphyritic elements have continued to grow after the intrusion, and the large orthoclase crystals belong wholly to this stage of the consolidation: the author dissents from the view that phenocrysts are always to be regarded as representing the first or intratelluric period of crystallisation and the ground-mass the second period. In these rocks the ground-mass is of very constant characters, being essentially a granular aggregate of orthoclase and quartz. The several varieties may be grouped generally as porphyrites, usually hornblende-porphyrite, in some cases quartz-porphyrite.

In conclusion we shall briefly notice some of the petrographical memoirs issued as bulletins from the laboratory of the University of California, which, under the direction of Lawson is producing some very useful work in the far West. The first instalment, by the Professor himself (29), deals with the geology of Carmelo Bay, some distance south of San Francisco. The chief interest, from a petrological point of view, centres in the eruptive rocks to which Lawson has given the name carmeloite. These exhibit variations of characters within certain limits, the silica percentage ranging at least from 52 to 60, so that the rocks hold in some respects a position intermediate between basalt and andesite. They have in some cases porphyritic augite and plagioclase, and the ground-mass varies from a holocrystalline one to one rich in glass. The special feature, however, is the presence of crystals of a mineral for which the name iddingsite is proposed. This substance occurs in crystal forms like those of olivine, with a lamellar structure due to a very perfect cleavage, and with a bronzy lustre on the cleavage faces. Optical examination proves the rhombic symmetry of the mineral, and reveals a brown colour with strong pleochroism. Qualitative chemical tests prove it to be a hydrous non-aluminous silicate of iron, lime, magnesia and soda. The characterisation of carmeloite by reference to this mineral seems to imply that the latter is, as Lawson inclines to believe, an original constituent of the rock, and

not a pseudomorph after olivine. Without prejudging this question, it may be remarked that numerous British basalts and diabases contain a mineral agreeing pretty closely with the description of iddingsite, but undoubtedly derived by alteration from olivine, unchanged relics of which sometimes remain in the heart of the pseudomorph.

Palache (30) has described a rock occurring as a lava-flow of late Cretaceous or probably early Tertiary age in the Contra Costa hills, north of Berkeley. It is an acid lava in which soda preponderates largely over potash, and it is accordingly styled soda-rhyolite. It shows gradations from a porphyritic variety with microcrystalline ground-mass to a pure glass, the bulk of the flow having a microspherulitic structure. One variety consists largely of spheroidal bodies up to three inches in diameter, hollow and containing chalcedony, etc. : these are probably altered large spherulites, and the author's account of them reminds us of those so frequently met with in the ancient rhyolitic lavas of North Wales and other districts.

The same geologist has investigated a blue soda-amphibole which seems to have a wide distribution among the crystalline schists of the Coast Ranges of California (31). The rock in which the mineral was specially studied consists of this mineral and albite. The mineral has the usual crystallographic habit and cleavages of a hornblende. It is strongly pleochroic in blue, violet, and yellowish-brown colours, and its extinction-angle is about 13°. It bears a considerable resemblance to riebeckite, and a chemical analysis places it between that mineral and glaucophane. The author names the new variety crossite, as apparently identical with a blue amphibole described by Whitman Cross in Custer County, Colorado, and one more soda-bearing amphibole is thus added to the number already recognised.

Another new rock-forming mineral has been described by Ransome and Palache (32, 33) from the Tiburon Peninsula, north of San Francisco, where it forms an important constituent of a particular crystalline schist. It has been found also in glaucophane-schists near Berkeley and else-

where, and may prove to have a more extended distribution. It is a rhombic mineral with simple crystallographic habit and two conspicuous cleavages, and it has a blue colour with strong pleochroism, which, however, is lost in ordinary thin slices. The specific gravity is 3·08, and the composition is expressed by the formula $H_4Ca\,Al_2\,Si_2O_{10}$, suggesting a comparison with the manganese mineral carpholite. To the new mineral the name lawsonite is given. It is associated in the rock with margarite, epidote, actinolite, glaucophane, and garnet. The glaucophane is peculiar as having an extinction-angle of 13° to 15°, much higher than in the normal mineral and perhaps indicating an admixture of the actinolite-molecule.

A very instructive memoir by Ransome deals with the geology of Angel Island in San Francisco Bay (34). This island consists mainly of the (probably Cretaceous) San Francisco Sandstone, with intercalated beds of radiolarian chert; but intruded into these are sills of a rock which is doubtfully placed with fourchite, and also a large dyke of serpentine derived from what has been essentially a diallage-rock. The so-called fourchite is composed mainly of augite, not in crystals but in granules of two sizes, with a matrix consisting of an aggregate of minute prisms of some colourless mineral. The latter is referred to zoisite, and is certainly secondary, possibly derived from felspar. There are varieties of the rock which contain little plagioclase prisms, and in particular a spheroidal variety in which the felspar occurs in skeletons, delicate needles, and brush-like groupings. The typical fourchite of Williams, it should be remarked, contains no felspar. The chief feature of interest, however, is the metamorphism produced by the intrusive masses in the bedded rocks, which are converted near the junction into glaucophane-schists. One of these, where the sandstone borders the main sill of fourchite, consists chiefly of glaucophane, albite, and biotite in varying proportions. In other specimens quartz is the chief constituent. The radiolarian cherts are changed into a rock composed of quartz with needles of glaucophane, actinolite, etc., and in less altered examples blue glaucophane needles have been

developed while the outlines of the radiolaria are still recognisable. Glaucophane-schist has also been produced at the contact of the sandstone with the serpentine. The blue amphibole mineral in these various rocks seems to be in general true glaucophane, though it is possible that crossite or other varieties may also occur. These observations are evidently of importance with reference to the origin of the glaucophane-schists in general of California, and perhaps of other districts. Lawson has expressed a confident opinion that all the glaucophane-, hornblende-, and mica-schists in the Coast Ranges are products of contact-metamorphism by basic eruptive rocks.

Some other points in the geology of Angel Island are of interest in connection with an earlier paper by the same author upon the eruptive rocks of Bonita Point, the northerly horn of San Francisco Bay (35). The strata here still belong to the San Francisco Sandstone, and include beds of "red jasper" corresponding with the radiolarian cherts mentioned above. The chief igneous rock is a basalt with what is for convenience called a spheroidal structure. The distinct portions into which the mass divides are, however, not spheroids but rather bale-like and pillow-like bodies, which give the effect of having been squeezed against one another while in a plastic state, a description which would apply to part of the "fourchite" of Angel Island and to some "spheroidal" basalts and diabases in other regions. The author expresses the opinion that the rock was poured out as a somewhat viscous lava (the viscosity being ascribed to the 2 or 3 per cent. of titanic acid present), successive sluggish out-pourings being piled upon one another, becoming sometimes spheroidal by rolling and sometimes lenticular by flattening. In addition to the basalt, there is at Bonita Point an intrusive diabase containing iddingsite, which Ransome regards as probably a pseudomorph after olivine. This has in places a spheroidal structure of a somewhat different kind attributed to a kind of flow-brecciation. The "fourchite" of Angel Island shows in one intrusion a spheroidal structure allied to brecciation, and in another the peculiar structure described in the basalt. The

author is thus brought to the conclusion that this feature is not restricted to surface-flows, but he believes that rocks exhibiting it must have been erupted under very nearly surface condition. This is to some extent in accordance with the opinion expressed by Fox and Teall with respect to the dolerite associated with the radiolarian chert of Mullion Island, Cornwall. This rock, "separated into rude rolls by curvilinear joints," they suggest may represent a submarine flow injected between the layers of the stratified series near the sea-bed during deposition. The association of these curious spheroidal rocks with radiolarian cherts at a number of localities in California and elsewhere seems significant, but the mechanism of igneous eruptions under a great pressure of water is a subject upon which it would not be safe to speculate at present.

We have already noted Ransome's account of the serpentine of Angel Island, which is demonstrated to be a decomposed diallage-rock. Palache (37) has described the serpentine of the Potrero, San Francisco, which is also of igneous origin and intrusive in the sandstones. In this case the rock has been derived from one consisting of olivine, enstatite, diallage, chromite, and magnetite, and so belonging to the lherzolite type. Lawson finds serpentine rocks in other parts of the district to be in all cases derived from igneous rocks, peridotites or pyroxenites.

The work embodied in the various memoirs which we have cited has gone far towards removing some serious difficulties felt by many readers with reference to the geology of the Pacific Slope as interpreted in Becker's monograph on the Quicksilver Deposits (1888). The San Francisco Sandstone and its associated rocks correspond with the Knoxville group of that writer, who endeavoured to explain the characters of many of these rocks by various obscure processes of metamorphism operating upon sedimentary deposits. The bedded jaspers are now proved to be not silicified shales, but original siliceous deposits, largely due to radiolaria, though Lawson believes much of the silica to have been chemically precipitated. The "pseudodiabases" and "pseudodiorites" of Becker, formerly stated

to be metamorphosed sediments, are all recognised as true igneous rocks, either contemporaneous or intrusive; and the serpentines, instead of arising from the metamorphism of various sedimentary rocks, are found here, as in other countries, to be decomposed basic and ultrabasic eruptives. Of the formidable series of supposed metamorphic rocks described in Monograph XIII. there remain only the glaucophane-bearing and other crystalline schists, and these seem to be in all cases contact-zones bordering intrusions of basic rocks (36).

BIBLIOGRAPHY.

(1) ADAMS, FRANK D. Ueber das Norian oder Ober-Laurentian von Canada. *Neu. Jahrb. für Min., Beil.* Bd. viii., pp. 419-498, 1893.

(2) LAWSON, ANDREW, C. The Anorthosytes of the Minnesota Shore of Lake Superior. *Bull. No.* 8 *of Geol. and Nat. Hist. Surv. Minn.*, pp. 1-23, 1893.

(3) BAYLEY, W. S. The Basic Massive Rocks of the Lake Superior Region. *Jour. of Geol.*, vol. i, pp. 433-456, 587-596, 688-716; vol. ii., pp. 814-825; vol. iii., pp. 1-20, 1893-5.

(4) KEMP, J. F. Gabbros of the Western Shore of Lake Champlain. *Bull. Geol. Soc. Amer.*, vol. v., pp. 213-224, 1894.

(5) KEMP, JAMES FURMAN. The Geology of Moriah and Westport Townships, Essex County, N.Y. *Bull. N.Y. State Mus.*, vol. iii., No. 14, pp. 325-355, 1895.

(6) SMYTH, C. H., Jr. Crystalline Limestones and Associated Rocks of the North-western Adirondack Region. *Bull. Geol. Soc. Amer.*, vol. vi., pp. 263-284, 1895.

(7) BAYLEY, W. S. A Fibrous Intergrowth of Augite and Plagioclase resembling a Reaction Rim in a Minnesota Gabbro. *Amer. Journ. Sci.* (3), vol. xliii., pp. 515-520, 1892.

(8) KEMP, J. F. The Nickel Mine at Lancaster Gap, Pennsylvania and the Pyrrhotite Deposits at Anthony's Nose on the Hudson. *Trans. Amer. Inst. Mining Engin.*, 14 pp. 1894.

(9) KEMP, J. F. Crystalline Limestones, Ophicalcites and Associated Schists of the Eastern Adirondacks. *Bull. Geol. Soc. Amer.*, vol. vi., pp. 241-262, 1895.

(10) PIRSSON, L. V. On some Phonolitic Rocks from Montana. *Amer. Jour. Sci.* (3), vol. l., pp. 394-399, 1895.

WEED, WALTER HARVEY. Phonolitic Rocks from Montana. *Ibid.*, pp. 506, 507.

(11) WEED, WALTER H. and PIRSSON, LOUIS V. Highwood Mountains of Montana. *Bull. Geol. Soc. Amer.*, vol. vi., pp. 389-422, 1895.

LINDGREN, W. A Sodalite-Syenite and other Rocks from Montana. *Amer. Journ. Sci.* (3), vol. xlv., pp. 286-297, 1893.

(12) WEED, W. H. and PIRSSON, L. V. Igneous Rocks of Yogo Peak, Montana. *Amer. Journ. Sci.* (3), vol. l., pp. 467-479, 1895.

(13) MERRILL, GEORGE P. Notes on some Eruptive Rocks from Gallatin, Jefferson, and Madison Counties, Montana. *Proc. U.S. Nat. Mus.*, vol. xvii., pp. 637-673, 1895. Review by Iddings. *Journ. of Geol.*, vol. iii., pp. 850, 851, 1895.

(14) IDDINGS, JOSEPH P. Absarokite-Shoshonite-Banakite Series. *Journ. of Geol.*, vol. iii., pp. 935-959, 1895.

(15) OSANN, A. Melilite-Nepheline-Basalt and Nepheline-Basanite from Southern Texas. *Ibid.*, vol. i., pp. 341-346, 1893.

(16) OSANN, A. Beiträge zur Geologie und Petrographie der Apache (Davis) Mountains, West Texas. *Tscherm. Min. u. Petr. Mitth.*, vol. xv., pp. 394-456, 1886.

(17) ADAMS, FRANK D. On the occurrence of a large area of Nepheline Syenite in the Township of Dungannon, Ontario. *Amer. Journ. Sci.* (3), vol. xlviii., pp. 10-16, 1894.

(18) HARRINGTON, B. J. On Nepheline, Sodalite and Orthoclase from the Nepheline Syenite of Dungannon, Hastings County, Ontario. *Ibid.*, pp. 16-18.

ADAMS, FRANK D., and HARRINGTON, B. J. On a New Alkali Hornblende and a Titaniferous Andradite from the Nepheline-Syenite of Dungannon, Hastings County, Ontario. *Ibid.* (4), vol. i., 210-218, 1896.

(19) MERRILL, GEORGE P. On some Basic Eruptive Rocks in the vicinity of Lewiston and Auburn, Androscoggin County, Maine. *Amer. Geol.*, vol. x., pp. 49-55, 1892.

(20) KEMP, J. F. The Elæolite Syenite near Beemerville, Sussex County, New Jersey. *Trans. N. Y. Acad. Sci.*, vol. xi., pp. 60-72, 1892.

(21) KEMP, JAMES FURMAN, and MARSTERS, VERNON FREEMAN. The Trap Dikes of the Lake Champlain region. *Bull. No.* 107 *of U.S. Geol. Surv.*, 1893.

(22) MARSTERS, VERNON F. Camptonite Dykes near Danbyborough, Vt. *Amer. Geol.*, vol. xv., pp. 368-371, 1895.

(23) MARSTERS, VERNON F. Camptonites and other Intrusives of Lake Memphremagog. *Ibid.*, vol. xvi., pp. 25-39, 1895.

(24) KEMP, J. F. A Basic Dike near Hamburg, Sussex County, New Jersey, which has been thought to contain Leucite. *Amer. Journ. Sci.* (3) vol. xlv., pp. 298-305, 1893.

KEMP, J. F. Additional Note on Leucite in Sussex County, New Jersey. *Ibid.*, vol. xlvii., pp. 339-340, 1894.

(25) SMYTH, C. H., Jr. Alnöite containing an uncommon Variety of Melilite. *Ibid.*, vol. xlvi., pp. 104-107.

(26) ADAMS, FRANK D. On a Melilite-bearing Rock (Alnöite) from Ste Anne de Bellevue near Montreal, Canana. *Ibid.*, vol. xliii., pp. 269-279, 1892.

(27) DARTON, N. H., and KEMP, J. F. A Newly Discovered Dike at De Witt, near Syracuse, New York. *Amer. Journ. Sci.* (3), vol. xlix., pp. 456-462, 1895.

(28) CROSS, WHITMAN. The Laccolitic Mountain Groups of Colorado, Utah and Arizona. 14*th Ann. Rep. U.S. Geol. Surv.*, pp. 157-241, 1895.

(29) LAWSON, ANDREW C. The Geology of Carmelo Bay. *Bull. Dep. of Geol., Univ. of Calif.*, No. 1., vol. i., pp. 1-59, 1893.

(30) PALACHE, CHARLES. The Soda-Rhyolite north of Berkeley. *Ibid.*, No. 2, vol. i., pp. 61-72, 1893.

(31) PALACHE, CHARLES. On a Rock from the Vicinity of Berkeley containing a New Soda Amphibole. *Ibid.*, No. 6, vol. i., pp. 181-192, 1894.

(32) RANSOME, F. LESLIE. On Lawsonite, a New Rock-Forming Mineral, from the Tiburon Peninsula, Marin County., Cal. *Ibid.*, No. 10, vol. i., pp. 301-312, 1895.

(33) RANSOME, F. L., and PALACHE, CH. Ueber Lawsonit, ein neues gesteinbildendes Mineral aus Californien. *Zeits. für Kryst.*, vol. xxv., pp. 531-537, 1896.

(34) RANSOME, F. LESLIE. The Geology of Angel Island. *Bull. Dep. of Geol., Univ. of Calif.*, No. 7, vol. i., pp. 193-240, 1894.

(35) RANSOME, F. LESLIE. The Eruptive Rocks of Point Bonita. *Ibid.*, No. 3, vol. i., pp. 71-114, 1893.

(36) LAWSON, ANDREW C. A Contribution to the Geology of the Coast Ranges. *Amer. Geol.*, vol. xv., pp. 342-356, 1895.

(37) PALACHE, CHARLES. The Lherzolite-Serpentine and Associated Rocks of the Potrero, San Francisco. *Bull. Dep. of Geol., Univ. of Calif.*, No. 5, vol. i., pp. 161-192, 1894.

ALFRED HARKER.

GOLD EXTRACTION PROCESSES.

FROM very early times the ancients were attracted by the beautiful colour, the brilliant lustre, and the indestructibility of gold, and spared no pains in the endeavour to acquire it. In the code of Menes, who reigned in Egypt some 2000 years before the time of Moses, the ratio of value between gold and silver is mentioned, one part of gold being declared equal in value to two and a half parts of silver, and it is, therefore, clear that the extraction of both metals from the deposits containing them must have been carried on before that time. It is indeed probable that gold was the first metal observed and collected, since it occurs in fragments of all sizes in loose sand, and the operations of collecting the larger pieces and melting them together are so simple. Among the rock carvings of Upper Egypt there are several illustrative of the art of washing auriferous sands by stirring and working them up by the hand in hollowed-out stone basins, and subsequently melting the gold in simple furnaces with the aid of mouth blow-pipes. The earliest of these carvings is supposed to date back to about 2500 B.C. However, in ancient times gold appears to have been mainly derived from India, and that country continued to supply most of the gold used in Europe until the discovery of America by Columbus.

In order to collect alluvial gold, the sands were washed down over smooth sloping rocks by means of running water, and the particles of gold sinking to the bottom of the stream by reason of their high density, were entangled and caught by the hair on raw hides spread on the rocks. Among the hides used were sheepskins, and hence originated the form of the legend of the Golden Fleece. Stripped of its heroic dress this legend of course describes a piratical expedition to win gold which was being obtained from streams with the help of sheepskins by the inhabitants of what is now Armenia. Similar

expeditions have not been unknown in much later times, and the method of obtaining gold by washing river sands is still practised with improvements in matters of detail in many parts of the world. Hides are even now occasionally employed to catch the gold, but sheepswool when used is generally in the form of blankets.

The use of mercury as an aid in the collection of gold contained in river sands or in crushed rock is also of great antiquity. The earliest mention of quicksilver itself appears to occur in the works of Theophrastus, about B.C. 300; but Diodorus of Sicily, who saw gold being extracted from quartz in Upper Egypt in the time of Julius Cæsar does not refer to its use.[1] Only a few years later, however, Vitruvius,[2] about B.C. 13, described the manner in which, by the help of quicksilver, gold was recovered from cloth in which it had been interwoven, and in Pliny's time the separation of gold from its impurities generally by the same means was well known.[3] It is probable that this knowledge was never afterwards entirely lost, although the references to it in the Middle Ages are very scanty. For example Geber[4] in the eighth century was aware that mercury would dissolve considerable quantities of gold and silver, but not earthy materials, and Theophilus the monk,[5] in the eleventh century carefully described the method of washing the sands of the Rhine on wooden tables, the final operation consisting in treating the concentrates with quicksilver for the removal of the gold. Biringuccio[6] was taught the secret of this use of mercury in Italy some time before 1540 in return for the present of a valuable diamond ring, and it is clear that the so-called invention of the amalgamation process in Mexico by the Spaniards in 1557

[1] Diodor., iii., 13. A full translation is given by B. H. Brough in his Cantor lectures on Mine Surveying. *Jour. Soc. Arts*, 1892.

[2] Vit. lib., vii., cap. 8.

[3] Nat. Hist., lib. xxx., cap. vi., sect 32. Quoted in full in Percy's Metallurgy of Silver and Gold, p. 559.

[4] Salmon's *Geber*, cap. 47.

[5] Theophili, lib. iii., cap. 49.

[6] De la Pirotechnia. Venetia, 1540. Lib. ix., cap. xi., fol. 142.

was only the introduction or adaptation of a process already well known in Europe.

The existing methods of washing auriferous sands all depend on two principles, the great density of gold when compared with that of the siliceous material with which it is associated, and, as Baron Born expressed it over 100 years ago, the "elective affinity" of mercury for gold when mixed with impurities. The ease with which gold-amalgam can be collected in spite of its being less dense than gold is of course due to the fact that it is miscible in all proportions with mercury, so that under proper conditions large globules of liquid alloy are formed by the running-together of smaller particles, and the former are readily caught in suitable crevices.

A large number of implements of varied form and efficiency are used in different parts of the world to apply these principles. In operations on a small scale the *batea*, the trough, and the miner's pan are chiefly used. In South America, in West Africa, and in parts of China, the *batea* is used, a wooden vessel having the shape of a very short reversed cone. When held in the hands and filled with gravel and water, a peculiar gyratory motion imparted to it results in the collection of the gold in the apex of the cone, and the light material can then be readily washed away.

A small wooden trough, twelve or fifteen inches long, is used for the same purpose in the far East by the Chinese, the Tonquins, the Annamites, the Malays, and others, the water being made to flow up and down until the gold has settled to the bottom. The miner's pan, a flat-bottomed iron vessel with sloping sides, was first used by the Californian pioneers, but has now become the favourite implement of Europeans for prospecting in all parts of the world. In early days in Australia and California millions of ounces of gold were obtained from the river gravels by its use, but apart from its value in prospecting it is at most a rough and ready means of treating small quantities of rich material, and is only suitable to individual effort.

In combined efforts to treat larger quantities of sand, the machines all consist essentially of a slightly inclined trough, through which a stream of water is made to convey the auriferous sand, mercury being usually sprinkled on at short intervals of time. If the trough is long enough, and the stream of water not too rapid, the gold and mercury sink, and, uniting, are swept along together, until arrested by some inequality of the bottom.

Crevices and "riffles" or obstructions of various kinds are arranged to catch the amalgam. The simplest contrivances are transverse slats of wood nailed to the bottom of the trough or sluice. In Siberia square "pigeon-hole" depressions have been continuously used for more that fifty years. In California, the sluice is paved with square blocks of wood placed an inch or more apart, or with large rounded stones, or ordinary iron rails between which are plenty of crevices where the amalgam can lodge. To catch light spangles of gold, blankets are spread, the loose fibres of which become charged with pyrites and gold, and in New Zealand, plush is a favourite gold catcher.

When a "clean-up" is desired, a stream of clear water is run through the sluice, the riffles are taken up, the mercury and amalgam washed down and allowed to accumulate at some convenient spot, and then ladled out and squeezed in bags of canvas or leather as in the days of Pliny, who describes the process as follows: "ut et ipsum [*i.e.*, argentum vivum] ab auro discedat, in pellis subactas effunditur, per quas sudoris vice defluens purum relinquit aurum". The excess of mercury being thus filtered off, the pasty amalgam, containing about one-third of gold, is retorted.

The methods of conveying the auriferous material to the sluices vary with the scale of the operations and the other conditions. When rocking cradles or the smaller sluices are used, the gravel is shovelled into them. In Siberia, where the valleys are shallow and the inclination of the ground small, the gravel is carried in carts up an inclined plane to an elevated wooden platform whence the sluice starts. In California, where the gulches are deep, the fall

of the ground rapid, and the auriferous deposits of great thickness, the banks of gravel are attacked by jets of water of tremendous power, and the earth washed down and carried through the sluices without being touched by hand, the so-called "hydraulic method". When the gravel beds are below the general level of the country they are raised by the "hydraulic elevator," a jet of water, under a head of as much as 400 or 500 feet, carrying water, sand, and boulders alike up a pipe inclined at some 60° to the horizon, so as to deliver them all at the head of the sluice, the vertical lift being sometimes over 40 feet.

One of the main difficulties in the hydraulic process is in the disposal of the tailings, which are usually discharged into a river or into the sea. The enormous amount of loose sand and gravel, delivered from the hydraulic mines into the Yuba and Feather rivers, California, prior to 1880, filled up their beds to such an extent that in rainy weather disastrous floods ensued, and much valuable agricultural land was buried beneath sterile drift deposits and rendered worthless. The farmers thereupon took action against the mining companies and obtained a perpetual injunction forbidding the discharge of tailings into these rivers. The result has been to stop the use of the hydraulic method in these important districts, and an apparently irreparable blow was inflicted on gold winning industry in California.

In every country as soon as the richest of the placer beds have been worked out, efforts are made to extract the gold from quartz veins. The quartz must of course be crushed, and the crushed material has in the past been generally treated similarly to the auriferous sands occurring naturally. Thus, according to the account given by Diodorus Siculus already referred to, the quartz was reduced to coarse powder by pounding it in stone mortars, then finely ground in handmills resembling the flour mills of the present day, and finally washed down over inclined planks with water, when the lighter material was carried away and the heavy gold retained on the wood. Hollowed-out stone mortars suitable for the first of these operations have been found in many

parts of the world, including Wales, Central America, the Pyrenees, and Transylvania. The stamp mill has no doubt been evolved from the pestle and mortar, but was not used for crushing ores until about the year 1519 when the process of wet stamping and sifting was introduced by Paul Grommestetter in Joachimsthal, the two operations, however, being at first kept distinct.

Agricola has given an exact description of the treatment of auriferous quartz in Germany in 1556,[1] from which it appears that the methods in use at that time were strikingly similar to those still employed in Transylvania and the Tyrol, which were among the districts of which he wrote. Doubtless in these districts the methods have been handed down from generation to generation with little change, while in other countries where they were introduced hundreds of years later the changes have been rapid and striking. In those points in which the older Tyrolean practice differed from the modern one, it resembled the procedure of the old Egyptians. The wooden stamps, shod with hard stone or iron, were arranged in sets of three, and raised by cams to fall by gravity when released. The rock was shovelled dry into the mortar, and coarsely crushed by the blows of the stamps.

Next it was ground as fine as flour in a stone mill supplied with water, and carried by the stream of water into the uppermost of three wooden tubs, whence it overflowed in succession into the other two. Revolving mechanical stirrers furnished with six paddles kept in agitation the contents of the tubs, and "separate even very minute flakes of gold from the crushed ore. These flakes, settling to the bottom, are drawn to itself and cleansed by the quicksilver (lying in the tubs), but the water carries off the dross."[2] Agricola here expounds the theory of amalgamation still adhered to in Austria, where mercury is regarded merely as a useful means of collecting particles of gold which have already been separated from the crushed ore by their great

[1] Agricola. De Re Metallica, p. 233. Basel, 1556.

[2] Agricola, *loc cit.*

density. The Tyrolean bowls still in use at Vöröspatack in Hungary and in a few retired valleys in the Eastern Alps do not differ essentially from the tubs drawn and described by Agricola; and, although wet crushing by the stamps has been introduced, the mortar is not usually furnished with screens.

Elsewhere, the changes in stamp battery amalgamation since Agricola wrote his treatise have been many and great. One of the first was the addition of screens in the side of the mortar, so that the two operations of crushing and sifting were united. In 1767 M. Jars saw these in use in the Hartz,[1] though even then only a single screen of brass wire twelve inches square delivered the product of three stamps, and in several other districts of Germany screens had not been adopted. The most important improvement however has undoubtedly been the introduction of the amalgamated copper plate for catching gold, the complement of the practice of charging mercury with the ore into the battery and so combining the operations of crushing and amalgamation. No mention of either this practice or the use of copper plates appears to have been made before stamp batteries began to work in California in 1850, although they had very likely been used in Georgia for some time previously.

The use of the copper plate was probably suggested by the experience in Mexico and South America of the working of the Cazo process, in which it was well known that amalgam tended to adhere to the copper sides of the vessel unless the proportion of mercury to gold and silver present was less than four to one. Thus Baron Born wrote in 1786[2]: "In new kettles . . . the inside becomes wholly and so perfectly silvered that it never can be cleaned. . . . The silvery coat is daily increased by slow and gradual apposition, and the crusts of amalgama, accumulating on the bottom and sides of the vessels, become gradually so thick that on emptying them they often fall off by their own

[1] *Voyages Métallurgiques*, vol. ii., p. 309. Paris, 1780.

[2] Baron Inigo Born's *New Process of Amalgamation*, p. 122, Translated by Raspe. London, 1791.

weight as silver plates, which, when dry, show the laminated texture of their daily augmentation."

The knowledge of this behaviour of amalgam in the Cazo process must have been common to many who were engaged in exploiting the quartz veins of the West soon after their discovery, and the speedy application of this knowledge is exactly what might be expected from those sturdy pioneers. Nevertheless, the exact date and locality of the introduction of the copper plate remains a matter for conjecture.

The copper plates fixed on the battery in the early fifties were about four inches wide and as long as the mortar, and were placed one on the "feed" side and one on the discharge side just underneath the screens. It was soon found that the plates worked better from the start if mercury was rubbed on them before they were placed in position, and this has now been invariably done for many years. Crushed ore, stones, water, and amalgam are flung violently against the plates and the amalgam is retained in great part.

The scouring action of the pulp on the plates is however always great, and becomes more violent in proportion as the stamps are larger. These are now as much as 1100 and even 1250 lbs. in weight in the Transvaal, an enormous mass when compared with the 750 lb. stamp of a few years ago, and the 120 lb. stamp of the last century. With this increase in weight, it has become desirable to modify the use of the copper plate. The plate on the feed side, long ago condemned by many, is accordingly being discarded more and more, and that below the screens is curved away in such a manner that it cannot be struck directly by the splash from the stamp, while slots in cast-steel plates lining the mortar have been devised for the purpose of catching amalgam.

After leaving the mortar the pulp was treated forty years ago mainly by passing it over inclined tables covered with blankets, much in the same way as Jason may have seen the golden sands worked in Asia Minor. The sands accumulating on the blankets were washed off at intervals

and ground in mills with mercury. In addition the ore was frequently passed over or through baths of mercury (as is still done in many Australian mills) and concentrated in various ways. Amalgamated copper plates over which the pulp flowed were tried, but in Western America were at first almost everywhere rejected,[1] probably owing to the great depth of the stream of ore and water made to flow over them. When this mistake began to be rectified some twenty-five years ago the value of the plates was soon recognised in California.

In the extraction of gold from crushed ore by means of amalgamated copper plates, the pulp is led over their surface in a very thin stream, not more than a quarter of an inch deep. The plates are slightly inclined, wider than the screens from which the pulp issues, and from six to twelve feet long. The pulp does not run down in a regular stream, but in a series of little wavelets which tumble over and over and are supposed to bring every part of the pulp in succession in contact with the amalgamated surface. The catching powers of the plates are thus supposed to be practically independent of the tendency of the particles of gold or amalgam to sink to the bottom of the stream. This theory is not accepted by the Austrian school, and it is certain that native gold is caught more easily in proportion as it contains less silver, so that when the particles of metal consist of an alloy largely consisting of silver, and are therefore of comparatively low density, the yield on the plates is generally poor. In any case, however, the amalgamated plate should theoretically be better adapted for its work than the Tyrolean mill and other machines using mercury baths, owing to the slight depth of the pulp on the plates and the short distance through which the gold particles are compelled to settle before reaching a catching surface. The plates are wiped down with rubber or brushes about once a day and the gold separated in the usual way from the excess amalgam thus collected.

[1] See Nevada and California Processes of Silver and Gold Extraction, p. 61, by G. Küstel, San Francisco, 1863.

Admirable as is the amalgamation process in many respects, it has always been recognised that the extraction of gold by its use is generally far from complete. Besides the comparatively large particles of free gold which are readily saved by amalgamation, all ores contain more or less gold in an excessively fine state of division (the *aurum larvatum* or "disguised" gold of the last century) as well as gold contained in sulphides (*aurum mineralisatum*), and these particles cannot be extracted by the copper plates.

In an investigation on the dimensions of gold particles in ores J. A. Edman[1] observed a single chip of quartz $\frac{1}{50}$ inch in diameter which, when magnified 50 diameters, showed over 300 particles of gold, varying in size from $\frac{1}{1000}$ to $\frac{1}{12000}$ inch not only on the surface of the stone but scattered through the transparent mass. Higher powers showed still greater numbers of smaller particles. The gold contained in pyrites, if, as seems likely, it is generally free, must be often still finer. It has been likened to the mortar in a brick wall, and is almost as difficult to catch as the motes in a sunbeam. Prolonged grinding with mercury no doubt increases the chances of such gold being amalgamated, and hence the success which has frequently attended the use of the Mexican arrastra, where the grinding surfaces are of stone, and of its successor the iron amalgamating pan.

Nevertheless, the yield of gold, mainly owing to the "flouring" and "sickening" of the mercury, is not always good even in these slow-working and therefore costly machines. Mercury, when triturated with ore for a long time, tends to break up into very fine particles which, although apparently clean and bright under the microscope, refuse to run together, and are carried away by the stream of water and lost, together with the gold already taken up by them. Such mercury appears greyish-white, and is said to be "floured". Moreover, when base metals are present in the ore they become amalgamated, and then, oxidising, coat the surfaces

[1] *Mining and Scientific Press.* San Francisco, 12th August, 1892.

of the globules of mercury with black scum, which effectually prevents the amalgam from adhering either to gold or to amalgamated plates. This "sickening" is doubtless also caused by the formation of compounds of the mercury itself. Ores containing sulphides of arsenic or antimony (which are reduced by mercury) are particularly apt to cause "sickening," but manganese dioxide, partly decomposed copper pyrites, zinc blende, and galena are also harmful.

It has been well known ever since the time of Agricola that the gold contained in these minerals, although not easy to extract by mercury, may be readily obtained by concentrating the ore (all finely divided free gold being, of course, lost in the process); the concentrates are then smelted, the gold accumulated in a reduced metal, such as lead or copper, and subsequently separated by cupellation or other means. The impossibility of applying this method of procedure to individual mines far distant from coal beds, and in places where a mixture of different kinds of ore cannot be obtained, prevents the universal application of the method, although in the neighbourhood of such smelting centres as Freiberg and Denver nothing better is required.

The chlorination process, now nearly fifty years old, is of more general value for treating concentrates. Chlorine is a somewhat slow solvent for gold, any particle occurring native which is visible to the unassisted vision requiring many hours for its complete dissolution; but it is well adapted to dissolve the fine flakes existing in pyrites. Unfortunately chlorine has a strongly preferential action on sulphides, and to avoid the enormous waste of gas which a small percentage of these substances cause it is necessary to precede chlorination by careful and complete roasting. After this there is little difficulty in the process. Oxides of the metals, except the alkaline earths, are very slowly attacked by chlorine; and when the alkaline earths are present salt is added in the roasting furnace. Chlorine is applied to the slightly damped ore in the form of gas, or, in more modern practice, as a strong aqueous solution.

After a day or two the liquid is filtered off, and the gold precipitated by ferrous sulphate or sulphuretted hydrogen.

The problem of the extraction of gold contained in pyrites and complex minerals was partially solved by the chlorination process, but the cost of roasting is a stumbling block in many cases, and it was the desirability of avoiding this which led to the introduction of the use of cyanide solutions for leaching, probably the most important event in the history of the metallurgy of gold since the first application of mercury to gold extraction. The extraordinary properties of very dilute solutions of cyanide of potassium were unmarked and in great part unknown until quite recently. That metallic gold is soluble in alkaline cyanides unaided by an electric current remained an interesting but useless fact until it was found that a solution containing only one per cent. of potassium cyanide dissolves gold at least as rapidly as much stronger solutions, although it has a very slow and partial action on most sulphides and other minerals occurring in gold ores. The presence of free oxygen is necessary for the dissolution of the gold, which takes place according to the equation—

$$4\,Au + 8K\,Cy + O_2 + 2\,H_2O = 4K\,Au\,Cy_2 + 4KHO.$$

The oxygen is supplied from the air entangled in the porous ore, or dissolved in the solutions, in which MacLaurin[1] has shown that it can be retained in the presence of alkaline cyanides in spite of its rapid absorption by the latter with the formation of cyanates. The gold can be recovered by precipitation on zinc and subsequent melting, or by electro-deposition on suitable cathodes, of which lead only has been largely used.

The development of the cyanide process proceeded apace as soon as it had been introduced. The mechanical improvements devised were numerous, the most important being the enlargement of the size of the leaching vats, until the largest now hold 600 tons of ore. The chief chemical improvements have been the introduction of the use of

[1] *Jour. Chem. Soc.*, vol. lxiii., p. 724 (1893).

caustic soda or lime to neutralise the acids and acid salts in "weathered" pyritic ores, and the reduction in the strength of solutions, the favourite "strong" solution now containing from 0·25 to 0·30 per cent. of available KCy, while solutions as weak as 0·01 per cent. are found in many cases to be equally efficacious if a somewhat longer time is allowed. In accordance with the experience in the extraction mills MacLaurin[1] has found that gold and silver in the form of plates are most rapidly dissolved by solutions containing from 0·1 to 0·4 per cent. of cyanide, the maximum rate being observed with solutions containing about 0·25 per cent. of cyanide of potassium. A fairly rapid rate of dissolution however is still observable when only 0·005 per cent. of KCy is present.

Cyanide of potassium acts rapidly when free oxygen is present in large quantities, as for example when gold floats on the solution, with its upper side dry. Under such conditions, cyanide is at least as rapid in action as chlorine, but in proportion as the supply of free oxygen falls off, the rate of dissolution of gold in cyanide becomes slower, and when air is excluded as rigidly as possible, hardly any action can be observed. In practice these facts are of importance. Finely divided gold in ordinary ores is dissolved in two or three days. When concentrates containing a large proportion of sulphides are being treated, however, free oxygen is absorbed by the pyrites as well as by the solution, and the treatment lasts as much as two or three weeks with a corresponding increase in the destruction of the cyanide by the minerals in the ore. An artificial supply of oxygen or of oxidising agents shortens the time required, but increases the waste of cyanide. Moreover, when pyritic ores or concentrates contain much marcasite and, in many cases, when copper sulphides or some other minerals are present, the process is useless, enormous quantities of cyanide being converted into other compounds before any gold is dissolved.

The process is therefore of limited application to complex ores and concentrates generally, although of wide applicability to ores comparatively free from sulphides,

[1] *Jour. Chem. Soc., loc. cit.* and vol. lxvii., p. 199, 1895.

especially after the coarser particles of gold have been removed by amalgamation. Certain deposits of complex ores, above the average in richness, are at present left untouched for want of a process by which they can be treated.

The cost of treatment of gold ores by the processes described above of course varies enormously with the locality and the special conditions of the case. Under favourable conditions the following may indicate approximately the minimum amount of gold which must be present in an ore, in order that it may be treated at a profit by the most suitable process. Auriferous sand, washed in the miner's pan, must contain about one part of gold in 100,000 or say six pennyweights per ton of ore. When the sluice is used, the sand being excavated and carried to the sluice by hand labour, as in Siberia, there must be at least one part of gold in 2,500,000 parts of sand or six grains to the ton. When the hydraulic method is possible, only one part in 18,000,000 may be enough, or three-fourths of a grain of gold per ton, a proportion about equal to that which Liversedge[1] found to exist in the sea water off the east coast of Australia. If the gold is contained in quartz, the cost of mining and of crushing the stuff makes the whole process of treatment far more expensive. Excluding the cost of mining, however, the cost of crushing and amalgamation requires the presence of at least one part of gold in 400,000, or say one and a half dwts. per ton. The cost of chlorination is equal to not less than one part of gold in 200,000 of ore or three dwts. per ton, although if only applied to concentrates, the cost per ton of the original ore may be trifling. Lastly, the cyanide process might be applied to the crushed tailings from the amalgamation process if they contain more than one part of gold in 600,000 or one dwt. per ton. If the ore has to be crushed, it must of course be richer. As stated above, these estimates apply only when the conditions are the most favourable. In general, such poor ores could not be worked at a profit.

[1] *Proc. Roy. Soc. of N.S.W.*, 1895.

At the present time the annual production of gold from all these sources is about £42,000,000 per annum, or double the output of seven years ago. It is greater than at any previous period in history, the nearest approach to it having been made in 1853, when the river gravels of California and Australia were at their best. The output was then estimated at £38,000,000.

Of the present output, washing processes, formerly instrumental in producing by far the larger proportion of the gold won, are now probably answerable for no more than 30 per cent. The amalgamation of crushed vein stuff, now the most important process, produces about 55 per cent. of the whole gold production. The two wet processes, chlorination and cyanide, account for some 11 per cent. of the output, of which about two-thirds are contributed by the cyanide process, and, lastly, smelting perhaps produces 3 or 4 per cent. of the total. In the future, as placer gravels become exhausted more and more, the proportion of the output derived from them will continue to fall off, and the greatest increases will certainly take place in the produce from stamp battery amalgamation and the cyanide process. The output from chlorination and from smelting has been for some years stationary or declining, and their proportion of the world's production will doubtless suffer a continued though gradual reduction. It is obvious that by new discoveries the whole direction and progress of the art might be modified. As the old deposits become exhausted the miner is compelled to go deeper into the earth and the metallurgist to treat poorer and more refractory ores. "Such is the vast labour expended on the extraction of gold. And from this description I think it is clear that gold is hard to get as it is difficult to keep; and though all men long to get it, yet when they have it they find as much pain as pleasure in the use of it." [1]

T. K. Rose.

[1] Diodorus Siculus, book iii., chap. 12. Quoted by B. H. Brough, *loc. cit. antea.*

THE MOST RECENT VALUES OF THE MAGNETIC ELEMENTS AT THE PRINCIPAL MAGNETIC OBSERVATORIES OF THE WORLD.

From Data kindly supplied by Kew Observatory Committee.

THE data in the table are deduced from hourly readings of the magnetic curves in the case of Pawlowsk, Katharinenburg, Copenhagen (Declination and Horizontal Force), Hamburg (Declination), Wilhelmshaven (Declination), Potsdam, Irkutsk, Utrecht (Declination), Kew, Greenwich, Uccle (Declination), Falmouth (Declination and Horizontal Force), Parc Saint Maur, Vienna, Pola, Nice (Declination), Perpignan, Tiflis, Washington, Zi-ka-wei, Manila, Batavia, and Mauritius.

In the case of Kasan (Declination and Horizontal Force), Prague (Declination and Horizontal Force), O'Gyalla (Declination and Horizontal Force), Madrid (Declination), Coimbra (Declination), and Lisbon (Declination), the diurnal inequality has been at least partly allowed for by the employment of readings at two or more hours of the day.

The first results of Inclination and Vertical Force at Greenwich are deduced from readings with 3-inch dip needles only, the second from readings with 3, 6, and 9 inch needles. Allowance has been made for a slight disturbance through recent building, in accordance with data kindly supplied by the Astronomer Royal.

The Declination at Kasan in last year's table was erroneously given as West.

Place.	Latitude.	Longitude.	Year.	Declination.
Pawlowsk - -	59° 41′ N.	30° 29′ E.	1894	0° 10′·5 E.
Katharinenburg -	56° 49′ N.	60° 38′ E.	1894	9° 39′·4 E.
Kasan - - -	55° 47′ N.	49° 8′ E.	1892	7° 30′·8 E.
Copenhagen - -	55° 41′ N.	12° 34′ E.	1893	10° 47′·7 W.
Stonyhurst - -	53° 51′ N.	2° 28′ W.	1895	18° 37′·8 W.
Hamburg - -	53° 34′ N.	10° 3′ E.	1895	11° 42′·7 W.
Wilhelmshaven -	53° 32′ N.	8° 9′ E.	1895	12° 52′·5 W.
Potsdam - - -	52° 23′ N.	13° 4′ E.	1891	10° 42′·2 W.
Irkutsk - - -	52° 16′ N.	104° 16′ E.	1894	2° 8′·0 E.
Utrecht - - -	52° 5′ N.	5° 11′ E.	1893	14° 28′·5 W.
Kew - - -	51° 28′ N.	0° 19′ W.	1895	17° 16′·8 W.
Greenwich - -	51° 28′ N.	0° 0′	1895	16° 57′·4 W.
Uccle (Brussels) -	50° 48′ N.	4° 20′ E.	1893	14° 48′·7 W.
Falmouth - -	50° 9′ N.	5° 5′ W.	1895	18° 54′·5 W.
Prague - - -	50° 5′ N.	14° 25′ E.	1895	9° 31′·5 W.
Parc St. Maur (Paris)	48° 49′ N.	2° 29′ E.	1893	15° 21′·1 W.
Vienna - - -	48° 15′ N.	16° 21′ E.	1894	8° 43′·6 W.
O'Gyalla (near Buda Pesth) - - -	—	—	1894	7° 58′·2 W.
Pola (on Adriatic) -	44° 52′ N.	13° 50′ E.	1895	9° 47′·0 W.
Nice - - -	43° 43′ N.	7° 16′ E.	1893	12° 32′·7 W.
Toronto - - -	43° 40′ N.	79° 30′ W.	1894	4° 43′·9 W.
Perpignan - -	42° 42′ N.	2° 53′ E.	1893	14° 10′·5 W.
Rome - - -	41° 54′ N.	12° 27′ E.	1891	10° 45′·1 W.
Tiflis - - -	41° 43′ N.	44° 48′ E.	1893	1° 38′·0 E.
Madrid - - -	40° 25′ N.	3° 40′ W.	1893	16° 14′·2 W.
Coimbra - - -	40° 12′ N.	8° 25′ W.	1893	17° 51′·7 W.
Washington - -	38° 53′ N.	77° 0′ W.	1892	4° 14′·2 W.
Lisbon - - -	38° 43′ N.	9° 9′ W.	1893	17° 49′·4 W.
Zi-ka-wei - - -	31° 12′ N.	121° 26′ E.	1894	2° 16′·5 W.
Hong-Kong - -	22° 18′ N.	114° 10′ E.	1894	0° 29′·2 E.
Colaba - - -	18° 54′ N.	72° 49′ E.	1894	0° 38′·6 E.
Manila - - -	14° 35′ N.	127° 11′ E.	1894	0° 50′·4 E.
Batavia - - -	6° 11′ S.	106° 49′ E.	1894	1° 27′·6 E.
Mauritius - -	20° 6′ S.	57° 33′ E.	1893	10° 2′·1 W.
Melbourne - -	37° 50′ S.	144° 58′ E.	1894	8° 13′·6 E.

Place.	Year.	Inclination.	Horizontal Force, C.G.S. Units.	Vertical Force, C.G.S. Units.
Pawlowsk - -	1894	70° 43′·6 N.	·16456	·47061
Katharinenburg -	1894	70° 40′·0 N.	·17799	·50729
Kasan - - -	1892	68° 36′·2 N.	·18551	·47345
Copenhagen - -	1893	68° 51′·0 N.	·17358	·44868
Stonyhurst - -	1895	68° 59′·2 N.	·17148	·44637
Hamburg - -	1895	67° 44′·3 N.	·18009	·43994
Wilhelmshaven -	1895	67° 54′·5 N.	·17983	·44305
Potsdam - -	1891	66° 44′·1 N.	·18635	·43342
Irkutsk - - -	1894	70° 10′·5 N.	·20116	·55796
Utrecht - -	1893	67° 12′·2 N.	·18397	·43772
Kew - - -	1895	67° 23′·8 N.	·18278	·43901
Greenwich - -	1895	{ 67° 15′·9 N. / 67° 14′·9 N. }	·18323	{ ·43727 / ·43692 }
Uccle - - -	1893	66° 28′·4 N.	·1877	·4311
Falmouth - -	1895	67° 0′·4 N.	·18547	·43708
Prague - - -	1895	—	·19834	—
Parc St. Maur -	1893	65° 7′·1 N.	·19621	·42304
Vienna - - -	1894	63° 12′·1 N.	·20740	·41061
O'Gyalla - -	1894	—	·21054	—
Pola - - -	1895	60° 34′·0 N.	·22026	·39038
Nice - - -	1893	60° 26′·4 N.	·22198	·39139
Toronto - -	1894	74° 35′·0 N.	·16624	·60286
Perpignan - -	1893	60° 11′·9 N.	·22304	·38944
Rome - - -	1891	58° 4′·6 N.	·2324	·3730
Tiflis - - -	1893	55° 45′·7 N.	·25692	·37751
Madrid - - -	1893	—	—	—
Coimbra - -	1893	59° 50′·5 N.	·22518	·38752
Washington - -	1892	71° 3′·9 N.	·19848	·57858
Lisbon - - -	1893	58° 24′·6 N.	·23270	·37840
Zi-ka-wei - -	1894	46° 0′·7 N.	·32613	·33785
Hong-Kong - -	1894	31° 53′·1 N.	·36450	·22675
Colaba - - -	1894	20° 40′·7 N.	·37426	·14126
Manila - - -	1894	16° 54′·3 N.	·37740	·11470
Batavia - - -	1894	29° 13′·7 S.	·36749	·20563
Mauritius - -	1893	54° 44′·3 S.	·23989	·33929
Melbourne - -	1894	67° 16′·9 S.	·23426	·55956

APPENDIX I.

NOTICES OF BOOKS.

Studies in the Evolutionary Psychology of Feeling. By Hiram M. Stanley. London: Swan Sonnenschein & Co. New York: Macmillan & Co., 1895. Pp. viii., 392.

The chief idea pervading the book is the importance of mind in evolution. The reasoning starts from the assumption that the primitive form of consciousness was pain, and pain is held to have been the essential factor in the evolution of mind by means of its stimulating action on volition. Not only the higher mental developments, but even the senses are supposed to owe their existence to conscious struggle in the effort to avoid pain. The course of evolution is supposed to have been pain—pleasure—vague cognition of object—sensation. In considering the emotions, of which fear is held to be the most primitive, the author does not believe in their gradual evolution, but supposes that such an emotion as anger appeared discontinuously in some favoured individual that derived advantage from the power of "getting mad" and violently attacking its fellows. The book is not scientific in method, but contains some useful discussions of psychological questions.

Milk; Its Nature and Composition. A Handbook on the Chemistry and Bacteriology of Milk, Butter and Cheese. By C. M. Aikman, M.A., D.Sc. London: Adam & Charles Black, 1895. Pp. xiv., 173. Price 3s. 6d.

In the space of less than 200 pages Dr. Aikman has contrived to give a good general account of the more important facts concerning milk—a valuable food which it behoves the general public no less than the milk purveyor and the dairy farmer to thoroughly understand.

Many persons having charge of children and invalids who subsist largely on milk have but a scanty knowledge of its composition and peculiarities: to these as well as to those in charge of dairy farms Dr. Aikman's book will prove of value, as in addition to a good description of the perfect article, the "faults" of milk, the bacteria found in it, and the food stuffs prepared from it are fully treated.

The value of the work is increased by the presence of well-selected figures in the text, and a short list of works on dairying in an appendix.

Handbuch der paläarktischen Gross-Schmetterlinge für Forscher und Sammler. Zweite gänzlich umgearbeitete und durch Studien zur Descendenztheorie erweiterte Auflage des Handbuches für Sammler der europäischen Gross-Schmetterlinge. Von Dr. M. Standfuess, Dozent beider Hochschulen und Kustos des Entomologischen Museums am eidgen. Polytechnikum zu Zürich, mit 8 lithographischen Tafeln und 8 Textfiguren. Jena: Gustav Fischer, 1896, 8vo, pp. xii., 392.

This book is a curious medley, combining several branches of entomology which we are seldom accustomed to see discussed in the same work, at least in England. The author complains in his preface that too many entomologists are mere collectors, or at least concern themselves only with questions of species; and therefore he has made his work not only a comprehensive handbook of the formation and management of a collection, but has added large sections relating to variation, dimorphism, hybridism, and other subjects connected with the origin of species, illustrated with eight coloured plates. Most of the varieties, hybrids, etc., represented belong to well-known British species. The more scientific portion of the book is in large measure an addition to the contents of the earlier and smaller edition.

The author is by no means satisfied with the present position of entomology among the sciences, which he attributes to the already mentioned neglect of scientific entomology among collectors. Apparently he hopes to contribute to an improvement in this direction, and he thus expresses his views in the preface:—

"This is the principal reason why the technical entomological literature of the time is almost totally neglected by scientific zoology, and ignored. In future it must not be thus.

Entomology must not be treated as a stepchild and Cinderella, to be neglected by her proud sister, but must work shoulder to shoulder with her as a faithful and equal comrade, carrying stones for the building which inquirers are endeavouring by honest work, upon a true knowledge of nature, to raise up as a harmonious whole."

A Handbook of British Lepidoptera. By Edward Meyrick, B.A., F.Z.S., F.E.S., Assistant Master at Marlborough College. London and New York: Macmillan & Co., 1895. 8vo, pp. vi., 843.

In this compact and closely-printed volume Mr. Meyrick has given us a convenient Students' Manual of British Butterflies and Moths, which was greatly wanted by all collectors who had outgrown the numerous popular books, which, as a rule, include only the butterflies and larger moths, the far more numerous "Micro-Lepidoptera" being omitted. Mr. Meyrick's work, however, includes all these in a single volume, not, of course, giving complete information on every point, but short descriptions and tables of genera and species, and notices of larvæ, times of appearance, and localities. We have many similar handbooks of botany and ornithology, and it is rather surprising that this is almost the first of its kind as regards *Lepidoptera.* There are no illustrations except woodcuts of neuration, a character to which Mr. Meyrick attaches a perhaps somewhat exaggerated importance. Enough has been and will be written elsewhere on the new classification of the *Lepidoptera* proposed by Mr. Meyrick, and we need only here allude to the fact of its being totally dissimilar to that adopted by any other entomologist.

Catalogue of the Mesozoic Plants in the Department of Geology, British Museum (Natural History). *The Wealden Flora.* Part II., "Gymnospermæ". With twenty Plates and nine Figures in the Text. By A. C. Seward, M.A., F.G.S. London: 1895.

Mr. Seward, of Cambridge, has for some time past been engaged on an examination of the fossil plants from the Wealden beds, contained in the collections of the British Museum. The material on which the investigation is based was for the most part collected by Mr. Rufford, whose valuable specimens have been acquired by the Museum. Mr. Seward's first volume, containing the "Cryptogams," appeared in 1894; the part now published completes the work, for, unfortunately, the English Wealden has not yet yielded any Angiospermous remains, although both Monocotyledons and Dicotyledons have been found in beds of similar horizon abroad.

The present volume is concerned with the two orders Cycadaceæ and Coniferæ. The author, however, points out that we are still to a large extent in the dark as to the exact nature and structure of extinct Cycadean plants. Beautiful as many of the specimens are, and striking as is the similarity of their organs to those of existing Cycads, we can seldom be certain that we have to do with Cycadaceæ, in the sense of recent Botany. There is nearly always the possibility that the remains may rather belong to the extinct family Bennettiteæ, allied to the Cycads, but deviating widely from them in the structure of the reproductive organs. Mr. Seward appears to recognise one species only (among those recorded in this book) as representing a truly Cycadean flower. This is his *Androstrobus Nathorstii*, which seems to be beyond doubt a male cone of the true Cycadean type. The other fructifications described are regarded as "*incertæ sedis*," or transferred to the Coniferæ, or else they belong unmistakably to the *Bennettites* type. This latter fructification, so thoroughly known from the researches of Carruthers, Solms-Laubach, and Lignier, is proved by the author to be well represented in the Wealden strata. He founds a new species—*Bennettites Carruthersi*—for some very fine specimens, which exhibit in great perfection all the more external characters of this extraordinary fructification. Mr. Seward identifies *Bennettites* with the famous *Williamsonia*, and inclines to the view that all the specimens which have been satisfactorily determined represent female inflorescences. Another species of *Bennettites* illustrates very finely the way in which the inflorescences were borne on the stem.

Certain Wealden stems had been referred by previous writers to *Dracæna.* The author rejects this determination, and shows that they bear a much greater likeness to certain Cycadean stems, especially those of some species of *Zamia.*

A most anomalous fossil, of uncertain affinities, is placed by Mr. Seward in a new genus—*Withamia.* It consists of a woody axis, bearing very large recurved spines, in the axils of which leaf-like organs, somewhat suggestive of a *Gingko*, are seated. Nothing like this is known among living plants, though *Phyllocladus* presents certain analogies.

Many beautiful coniferous specimens are recorded, from which it would appear (though the author here, as indeed everywhere, expresses himself with the most admirable caution) that most tribes of Coniferæ were already represented in the Wealden epoch. A new species of *Pinites* (*P. Solmsi*) shows both foliage and female cones very clearly, and decidedly suggests the recent genus, while in *Sphenolepidium Kurrianum* we have equally perfect specimens of another type, indicating an affinity to *Athrotaxis*.

The author considers that the evidence of Palæobotany certainly favours the inclusion of the Wealden rocks in the Jurassic series.

Such work as Mr. Seward's is of the greatest possible value. His book, with the help of the abundant and excellent illustrations (chiefly the work of Miss Woodward), gives us a vivid idea of the flora of a most interesting epoch. The author's remarkably sound judgment, and caution in estimating affinities, inspire great confidence in his results. It is only by such sober-minded work as this that real and permanent advance in fossil Botany can be assured.

Die Artbildung und Verwandschaft bei den Schmetterlingen. II. Theil. Eine systematische Darstellung der Abänderungen, Abarten und Arten der Schwalbenschwanz-ähnlichen Formen der Gattung Papilio. Von Dr. G. H. Theodor Eimer, Professor der Zoologie und vergleichenden Anatomie zu Tübingen. Unter Mitwirkung von Dr. K. Fichert, I. Assistent an der Zoologischen Anstalt daselbst. Mit 4 Tafeln in Farbendruck und 7 Abbildungen im Texte. Jena, 1895.

Times have changed since it was possible to regard a fondness for butterfly collecting as evidence which could be seriously brought forward in a court of justice in an attempt to set aside the will of a deceased lady on the ground of insanity. Gone, too, are the days when it was necessary for pious and learned gentlemen to explain to our fathers in long and elaborate essays that Entomology was not in itself either a frivolous or a cruel amusement. Yet the really cruel amusements of the beginning of the century have disappeared and are forgotten, while Entomology still holds its own, and to judge from the large number of books addressed chiefly to amateurs, is an increasingly popular amusement, while wise men are turning their attention to the despised butterflies in quest of information respecting some of the profoundest problems which are open to our scientific men along the present tracks of ordinary research.

It was Bates' famous paper on Mimicry which first began to raise the philosophical study of butterflies to the importance which it has now attained, and questions of mimicry, variation, adaptation, climate, and even of the past history of the world, and of the formation of species are eagerly discussed in the new light which the study of butterflies has thrown upon them.

Not only long and extended but much detailed examination is necessary before satisfactory results can be attained; and therefore works of a limited character like Dr. Eimer's[1] will always be important, quite apart from any theories which may be based upon them. Dr. Eimer contends that Natural Selection will not account for the origin of species, though it doubtless contributes largely to the preservation of species that are already formed. He also adduces instances in which the representative forms of a species or group of species appear to vary in a similar direction at the opposite extremities of its range; but perhaps his most important point is that variation always appears to occur along definite lines. We are glad to notice this, because, although it has frequently been noticed, it has generally been passed by without special comment. It would be impossible to discuss Dr. Eimer's theories at length; but we are sure that all who are interested in the philosophical study of butterflies will read his book with much interest.

[1] The present volume of his work is restricted to *Papilio Turnus*, *Machaon*, and *Asterias*, and their allies.

APPENDIX II.

CHEMICAL LITERATURE FOR JANUARY, 1896.

Vol. i. No. 2. *American Journal of Science.* (February, 1896.)

Walker, T. L., Notes on Sperrylite (pp. 110-113). *Penfield, S. L.*, and *Forbes, E. H.*, Fayalite from Rockport, Mass., and on the Optical Properties of the Chrysolite-Fayalite Group, and of Monticellite (pp. 129-136).

Vol. xviii. No. 1. *Journal of the American Chemical Society.* (January, 1896.)

Heidenhain, H., On the Determination of Carbon Dioxide by Absorption (pp. 1-8). *Cross, C. F.*, *Bevan, E. J.*, and *Beadle, C.*, The Natural Oxycelluloses (pp. 8-21). *Gill, A. H.*, and *Richardson, H. A.*, Notes on the Determination of Nitrites in Potable Water (pp. 21-23). *Gladding, T. S.*, A Gravimetric Method of Estimating Phosphoric Acid as Ammonium Phosphomolybdate (pp. 23-28). *Flintermann, R. F.*, and *Prescott, A. B.*, Dipyridine Trimethylene Dibromide and a Study of Certain Additive Reactions of Organic Bases (pp. 28-35). *Campbell, E. D.*, A Proposed Schedule of Allowable Difference and of Probable Limits of Accuracy in Quantitative Analyses of Metallurgical Materials (pp. 35-38). *Pennington, M. E.*, Derivatives of Columbium and Tantalum (pp. 38-67). *Gill, A. H.*, An Improved Gas Pipette for the Absorption of Illuminants (pp. 67-68). *Richards, E. H.*, and *Ellms, J. W.*, The Colouring Matter of Natural Waters; its Source, Composition and Quantitative Measurement (pp. 68-81). *Wiley, H. W.*, On the Estimation of Levulose in Honeys and other Substances (pp. 81-91). *Prescott, A. B.*, Notes on a few Pyridine Alkyl Iodides (pp. 91-96). *Rising, W. B.*, and *Lenher, V.*, An Electrolytic Method for the Determination of Mercury in Cinnabar (pp. 96-98).

Vol. xviii. No. 1. *American Chemical Journal.* (January, 1896.)

Jackson, J. C. L., and *Oenslager, G.*, On the Constitution of Phenoquinone (pp. 1-23). *Warder, R. B.*, The Mathematical Theory of Oxidation Processes (pp. 23-43). *Mabery, C. F.*, On the Composition of the Ohio and Canadian Sulphur Petroleums (pp. 43-80).

Vol. xxi. No. 239. *The Analyst.* (February, 1896.)

President's Annual Address (pp. 29-36).

Vol. lxix. No. 399. *Journal of the Chemical Society.* (February, 1896.)

Marsh, J. E., and *Gardner, J. A.*, Researches on the Terpenes. VI. Products of the Oxidation of Camphene, Camphoic Acid and its Derivatives (pp. 74-91). *Cohen, J. B.*, and *Archdeacon, W. H.*, The Action of Sodium Alcoholate on the Acid Amides (pp. 91-96). *Ewan, T.*, Note on the Electrolytic Conductivity of Formanilide and Thioformanilide (pp. 96-98). *Snape, H. L.*, On Certain Phenylthiocarbamates (pp. 98-102). *Shaw, G. E.*, Periodides of Theobromine (pp. 102-104). *Frankland, P. F.*, and *MacGregor, J.*, Ethereal Salts of Active and Inactive Monobenzoyl-, Dibenzoyl-, Diphenacetyl- and Dipropionyl-Glyceric Acids (pp. 104-123). *Frankland, P. F.*, and *Pickard, R. H.*, Rotation of Optically Active Compounds in Organic Solvents (pp. 123-142). *Nicol, W. W. J.*, The Molecular Volumes of Organic Substances in Solution (pp. 142-145).

Vol. xli. No. 249. *Philosophical Magazine and Journal of Science.* (Feb., 1896.)

Wood, R. W., On the Dissociation Degree of some Electrolytes at 0° (pp. 117-120). *Wood, R. W.*, The Duration of the Flash of Exploding Oxyhydrogen (pp. 120-123).

Vol. lix. No. 353. *Proceedings of the Royal Society.* (15th January, 1896.)

Lockyer, J. N., On the Gases obtained from the Mineral Eliasite (pp. 1-4). *Lockyer, J. N.*, On the New Gases obtained from Uraninite. VI. (pp. 4-9). *Kuenen, J. P.*, and *Randall*,

W. W., The Expansion of Argon and of Helium as compared with that of Air and Hydrogen (pp. 60-66). *Kellas, A.*, On the Percentage of Argon in Atmospheric and in Respired Air (pp. 66-68). *Kellas, A.*, and *Ramsay, W.*, Examination of Gases from certain Mineral Waters (pp. 68-69). *Lundström, C. J.*, Flame Spectra observed at Swedish Bessemer Works (76-98). *Hartley, W. N.*, Remarks on the Origin of some of the Lines and Bands observed in the Spectra from Swedish Bessemer Works (pp. 98-101).

Series vii. Tome vii. *Annales de Chimie et de Physique.* (February, 1896.)

Marie, T., Recherches sur les acides cérotique et mélissique (pp. 145-251). *Louguinine, W.*, Étude sur les chaleurs latentes de vaporisation des liquides (pp. 251-283). *Berthelot*, Sur la détermination thermochimique de l'équivalent des acides et des bases (pp. 283-288).

Tomes xv.-xvi. No. 2. *Bulletin de la Société Chimique de Paris.* (20th January, 1896.)

Lenoble, E., Sur le nouveau mode de représentation des courbes de solubilité des sels, proposé par M. Etard (pp. 54-58). *Rousset, L.*, Sur quelques acétones dérivées du naphtalène (pp. 58-72). *Cazeneuve, P.*, Recherches sur la décomposition des acides-phénols dérivés du benzène et du naphtalène (pp. 72-82). *Lauth, C.*, Sur quelques dérivés dithiazoliques (pp. 82-87). *Grimbert, L.*, Fermentations provoquées par le pneumobacille de Friedlander (pp. 87-96). *Béchamp. A.*, Sur les altérations spontanées du lait et sur celles que la cuisson lui fait subir (pp. 96-118). *Lasne, H.*, Sur le dosage de l'alumine dans les phosphates (pp. 118-128).

Tomes xv.-xvi. No. 3. (5th February, 1896.)

Brunel, H., Sur l'acide thioglyoxylique (éthanethioloïque) (pp. 134-135). *Bredt, J.*, et *de Rosenberg*, Synthèse partielle du camphre (pp. 135-142). *Prud'homme, M.*, Nouvelle synthèse de la parafuchsine et de ses dérivés mono-, di-, tri- et tetraalcoylés (pp. 142-146). *Lasne, H.*, Sur le dosage de l'alumine dans les phosphates. II. (pp. 146-158). *Colson, A.*, Essai sur le dosage polarimétrique de l'acide tartrique (pp. 158-162). *Winter, J.*, Note additionelle à un mémoire paru dans le *Bulletin de la Société Chemique* (3e serie, t. xiii., pp. 1101-1895), sur la température de congélation des liquides de l'organisme (pp. 162-163).

Tome cxxii. No. 1. *Comptes Rendus hebdomadaires de l'Académie des Sciences.* (6th January, 1896.)

Thomas, V., Action du peroxyde d'azote sur les sels halogénés d'étain (pp. 32-34). *Oechsner de Coninck*, Sur un mode de décomposition de quelques composés à fonction amide ou basique (pp. 34-35).

Tome cxxii. No. 2. (13th January, 1896.)

Amagat, E. H., Sur les variations du rapport des deux chaleurs spécifiques des gaz (pp. 66-70). *Violle, J.*, Un étalon photométrique à l'acétylène (pp. 79-80). *Le Chatelier, H.*, Sur la chaleur de formation de quelques composés du manganèse (pp. 80-82). *Tassilly*, Sur les iodures cristallisés de strontium et de calcium (pp. 82-84). *Barbier, P.*, et *Bouveault, L.*, Sur les aldéhydes dérivées des alcools $C_{10}H_{18}O$ isomériques (pp. 84-86). *Tanret*, Sur la multirotation des sucres redacteurs et l'isodulcite (pp. 86-87).

Tome cxxii. No. 3. (20th January, 1896.)

Amagat, E. H., Sur les chaleurs spécifiques des gaz et les propriétés des isothermes (pp. 120-121). *Parmentier, P.*, Sur la solubilité de l'hyposulfite de soude dans l'alcool (pp. 135-137). *Marie, C.*, et *Marquis, A.*, Sur le nitrosulfures de fer (pp. 137-140). *Besson, A.*, Action du chlorure de carbonyle sur quelques composés hydrogénés (pp. 140-142). *Meunier, J.*, Sur le dichloral glucose et sur le monochoral glucosane (pp. 142-144).

Tome cxxii. No. 4. (27th January, 1896.)

François, M., Action de la chaleur sur l'iodure mercureux (pp. 190-193). *Bayrac* et *Camichel, C.*, Sur l'absorption de la lumière par les dissolution d' indophénols (pp. 193-195). *Perrier, G.*, Combinaisons du chlorure d'aluminium anhydre avec les phénols et leurs dérivés (pp. 195-198). *Bouchardat, G.*, et *Tardy*, Sur l'essence d'anis de Russie (pp. 198-201). *Brochet, A.*, Sur la production de l'aldéhyde formique gazeuse pure (pp. 201-203).

Tome cxxii. No. 5. (3rd February, 1896.)

Meslans et *Girardet, F.*, Sur les fluorures d'acides (pp. 239-243). *Colson, A.*, Mode de préparation des fluorures d'acides (pp. 243-244). *Guntz*, Sur un hydrure de lithium (pp. 244-246).

16e Année. Tome iii. No. 2. *Journal de Pharmacie et de Chimie.* (15th January, 1896.)

François, Sur le protoiodure de mercure (pp. 49-53). *Marie, T.*, Sur l'oxydation des acides des graisses (pp. 53-55). *Bishop, W.*, Recherches sur la détermination du degré d'oxydation des huiles (pp. 55-61). *Meillère, G.*, Réactif molybdique (pp. 61-62). *Mouren, C.*, Synthèse du méthyleugénol (pp. 62-65). *Lépinois, E.*, Sur une préparation peu connue du chanvre indien (pp. 65-68).

16e Année. Tome iii. No. 3. (1st February, 1896.)

Bourquelot et *Bertrand, G.*, Les ferments oxydants dans les champignons (pp. 97-102). *Riche, A.*, Conservation des peaux par les préparations arsenicales (pp. 102-106). *Meillère, G.*, Essai des acides nitrique et chlorhydrique (pp. 106-107). *Marie, T.*, Sur les propriétés des acides cérotique et mélissique existant à l'état libre dans la cire d'abeilles (pp. 107-111). *Barthe, L.*, Analyse de concrétions intestinales (pp. 111-113). *Rebière, G.*, Sur un nouveau mode de dosage des benzoates alcalins (pp. 113-116). *Chicote, C.*, Une nouvelle falsification du safran (pp. 116-117). *Fouquet, L.*, Sur un calcul biliare contentant de l'acide stéarique (pp. 117-119).

Band cclxxxix. Heft 3. *Justus Liebig's Annalen der Chemie.* (7th January, 1896.)

Erlenmeyer, E., Ueber Phenyldihalogenpropionsäuren, insbesondere ueber Phenylchlorjodpropionsäure und einige Derivate derselben (pp. 259-285.) *Hantzsch, A.*, und *Wild, W.*, Ueber Oxime aus α-halogenisirten Aldehyden, Ketonen und Säuren sowie ueber Oximessigsäuren (pp. 285-310). *Smith, A.*, Ueber die Einwirkung von Hydrazin und von Phenylhydrazin auf 1,4 Diketone (pp. 310-337). *Wallach, O.*, Zur Kenntniss der Terpene und der ätherischen Oele (pp. 337-362). *Beckmann, E.*, Untersuchungen in der Kampherreihe (pp. 362-367). *Beckmann, E.*, und *Mehrländer, H.*, Zur Kenntniss der Menthone (pp. 367-391).

Band ccxc. Heft 1. (28th January, 1896.)

Thiele, J., und *Heuser, K.*, Ueber Hydrazinderivate der Isobuttersäure (pp. 1-43). *Traube, J.*, Ueber das Molekulare Lösungsvolumer und Molekularvolumen organischer Verbindungen (pp. 43-122).

Jahrgang xxviii. No. 19. *Berichte der Deutschen Chemischen Gesellschaft.* (13th January, 1896.)

Jackson, C. L., und *Ittner, M. H.*, Ueber Parabromdimetanitrotoluol und enige seiner Derivate (pp. 3063-3066). *Jackson, C. L.*, und *Phinney, J. J.*, Notiz ueber den Trinitrophenylmalonsäureester (pp. 3066-3068). *Ladenburg, A.*, Ueber Lysidin (pp. 3068-3070). *Schuftan, A.*, Ueber αμ-Dimethyloxazol (pp. 3070-3072). *Schneider, P.*, Ueber einige Alkylderivate des Aethylendiamins (pp. 3072-3078). *Lobry de Bruyn, C. A.*, und *van Ekenstein, A. W.*, Einwirkung von Alkalien auf Kohlenhydrate. Wechselseitige Umsetzung von Glucose, Fructose und Mannose in einander (pp. 3078-3082). *Lobry de Bruyn, C. A.*, Ueber die Ammoniakderivate der Kohlenhydrate (pp. 3082-3085). *Lobry de Bruyn, C. A.*, Ueber das freie Hydrazin (pp. 3085-3086). *Lobry de Bruyn, C. A.*, Darstellung und einige Eigenshaften des Hydrazinhydrats (pp. 3086-3087). *Hjelt, E.*, Ueber den Sogen. Ledumcampher (pp. 3087-3089). *Möhlau, R.*, und *Krubel, F.*, Ueber 1·2-Dioxy-3-naphtoësäure (pp. 3089-3096). *Möhlau, R.*, Ueber 2·3-Amidonaphtoësäure (pp. 3096-3100). *Möhlau, R.*, Zur Constitutionsfrage der 2·3-Oxynaphtoësäure und ihrer Derivate (pp. 3100-3102). *Landolt, H.*, Ueber eine veränderte Form des Polarisationsapparates für Chemische Zwecke (pp. 3102-3104). *Ladenburg, A.*, Erwiderung (pp. 3104-3106). *Abel, J.*, Ueber α-Naphtylpiperidin (3106-3111). *Bookman, S.*, Ueber β- und γ-Aethoxybutylamin (pp. 3111-3121). *Zincke, Th.*, Ueber eine neue Reihe von Chinonartigen Derivaten (pp. 3121-3127). *Wegscheider, R.*, Ueber die Esterbildung aus Säure und Alkohol (pp.

3127-3129). *Funk, R.*, Ueber den Schwefel- und Kohlenstoff-gehalt des Zinks (pp. 3129-3133). *Darmstaedter, L.*, und *Liffschütz, J.*, Beiträge zur Kenntniss der Zusammensetzung des Wollfettes (pp. 3133-3135). *Fischer, E.*, und *Lorenz, A.*, Synthese des Caffeïns (pp. 3135-3143). *Koenigs, W.*, Ersetzung von Hydroxyl in Chinaalkaloïden durch Wasserstoff I. (pp. 3143-3148). *Koenigs, W.*, Ueber einige Dicarbonsäuren von Piperidinbasen (pp. 3148-3151). *Besthorn, E.*, Ueber die Reduction der Chinolinsäure (pp. 3151-3160). *Paal, C.*, und *Jänicke, H.*, Ueber Sulfaminsäuren der aromatischen Reihe (pp. 3160-3167). *Feist, F.*, und *Arnstein, H.*, Ueber aromatische Homologue des Aethylendiamins (pp. 3167-3182). *Engels, C.*, Quantitative Bestimmung von Mangan und Zinn durch Elektrolyse (pp. 3182-3189). *Drechsel, E.*, Ueber die Abschiedung des Lysins (pp. 3189-3191). *Stobbe, H.*, Ueber die Condensation einfacher Ketone mit den Estern der Bernsteinsäure und Brenzweinsäure unter dem Einfluss von Natriumäthylat (pp. 3191-3195). *Meyer, V.*, Bemerkungen zur Abhandlung von Brühl: Ueber das Benzolproblem (pp. 3195-3197). *Meyer, V.*, Notizen der Geschicte der Esterbildung und Verseifung (pp. 3197-3201). *Shukoff, A.*, Ueber eine neue Erscheinung bei der Esterbildung durch Wirkung von Alkohol und Salzsäure auf aromatische Säuren (pp. 3201-3203). *Petrenko-Kritschenko, P.*, Ueber die sterische Hinderung Chemischer Reactionen (pp. 3203-3207). *Baum, F.*, Ueber den hindernden Einfluss orthoständiger Methylgruppen auf die Bildung der Oxime (pp. 3207-3212). *Baum, F.*, und *Myer, V.*, Ueber die Zweimalige Einführung der Acetylgruppe in aromatische Kohlenwasserstoffe (pp. 3212-3215). *Muhr, F.*, Ueber eine Gesetzmässigkeit bei der Spaltung aromatischer Ketonsauren (pp. 3215-3218). *Goldschmidt, H.*, Ueber die Esterificirung durch alkoholische Salzsäure (pp. 3218-3227). *Paal, C.*, und *Ganser, F.*, Ueber die Einwirkung von Phenyl-i-cyanat auf organische Aminosäuren (pp. 3227-3234). *Paal, C.*, und *Kromschröder, G.*, Ueber einige Derivate des m-Dibrom-p-oxybenzaldehyds (pp. 3234-3237). *Hantzsch, A.*, und *Freese, H.*, Ueber Thiodiazoverbindungen (pp. 3237-3252). *Fischer, E.*, und *Speier, A.*, Darstellung der Ester (pp. 3252-3258). *Herzig, J.*, und *Meyer, H.*, Zur Kenntnis der Phtaleïne (pp. 3258-3262). *Reformatzky, S.*, Neue Darstellungsmethode der αα-Dimethylglutarsäure aus der entsprechenden Oxysäure (pp. 3262-3265). *Slosson, E. E.*, Ueber die Einwirkung von unterbromiger und unterchloriger Säure auf Säureanilide (pp. 3265-3271). *Willstätter, R.*, Ueber die Aufspaltung der Tropinsäure (pp. 3271-3292). *Traube, J.*, Ausdehnung der Gesetze von Gay-Lussac und Avogadro auf homogene Flüssigkeiten und feste Stoffe (pp. 3292-3302).

Jahrgang xxix. No. 1. (27th January, 1896.)

Baeyer, A., Ortsbestimmungen in der Terpenreihe (pp. 3-27). *Baeyer, A.*, Ortsbestimmungen in der Terpenreihe (pp. 27-37). *Friedländer, P.*, und *Zinberg, S.*, Ueber einige 1-7 Derivate der Naphtalinreihe (Untersuchungen ueber isomere Naphtalinderivate II.) (pp. 37-42). *Marckwald, W.*, Ueber ein bequemes Verfahren zur Gewinnung der Linksweinsäure (pp. 42-43). *Marckwald, W.*, Ueber die optisch activen α-Pipecoline und das sogenannte Isopipecolin (pp. 43-52). *Schutz, O.*, und *Marckwald, W.*, Ueber optisch active Valeriansäure (pp. 52-59). *Miller, W. v.*, und *Plöchl, J.*, Ueber Thio-aldolanilin und Aldehydgrün (pp. 59-62). *Münch, G.*, Ueber Amidoxylisobuttersäure (pp. 62-65). *Vongerichten, E.*, Zur Kenntniss des Morphins (pp. 65-69). *Kahlbaum, G. W. A.*, Der sogenannte Liebeg' sche Kühl-apparat (pp. 69-71). *Kahlbaum, G. W. A.*, Normalsiederohr (pp. 71-73). *Kaufmann, V.*, Ueber Biphenylenediphenyläther (pp. 73-76). *Niementowski, St.*, Ueber das Chinacridin (pp. 76-84). *Piutti, A.*, Ueber die Einwirkung der Bernsteinsäure auf das p-Amido-phenol und dessen Aether (pp. 84-87). *Scholt, R.*, und *Landsteiner, K.*, Reduction der Pseudonitrole zu Ketoximen (pp. 87-90). *Born, G.*, Zur Kenntniss der Pseudonitrole und Dialkyldinitromethane (pp. 90-102). *Bamberger, E.*, Ueber die Einwirkung des Nitrosobenzols auf Amidoverbindunger (pp. 102-105). *Goldschmidt, C.*, Ueber die Einwirkung von Ammoniak auf den Benzoylessigester (pp. 105-106). *Buchner, E.*, Ueber Pseudophenylessigsäure (pp. 106-110). *Hjelt, E.*, Ueber die Verseifung der alkylsubstituirten Malonsäureester (pp. 110-111). *Weiler, M.*, Ueber die Enstehung von p-Tolylphenylmethan aus p-Bromtoluol und Natrium (pp. 111-115). *Weiler, M.*, Ueber die bei der Einwirkung von Natrium auf Brombenzol entstehenden hochmolekularen Kohlenwasserstoffe (pp. 115-119). *Tiemann, F.*, Zur Terpen- und Campherfrage (pp. 119-131). *Bistrzycki, A.*, und *Nencki, K.*, Notiz zur Constitution der Phenol-phtaleïn-Alkalisalz (pp. 131-133). *Walden, P.*, Ueber die

gegenseitige Umwandlung optischer Antipoden (pp. 133-138). *Herzig, J.*, und *Meyer, H.*, Nachtrag zur der Abhandlung: Zur Kenntniss der Phtaleïne (pp. 138-139). *Wörner, E.*, Beiträge zur Beurtheilung der Isomerie der Trithioaldehyde (pp. 139-160). *Gabriel, S.*, und *Stelzner, R.*, Ueber o- Nitrobenzylmercaptan (pp. 160-165). *Kühling, O.*, Ueber den Ersatz der Isodiazogruppe durch cyclische Reste. II (pp. 165-169). *Gundlich, C.*, und *Knoevenagel, E.*, Ueber Derivate des Dihydrochlorbenzols und ihre Dehydrirung (pp. 169-172). *Knoevenagel, E.*, Ueber eine Darstellungsweise des Benzylidenacetessigesters (pp. 172-174). *Liebermann*, C., Zur Tautomerie der o-Aldehydsäuren (pp. 174-183). *Liebermann, C.*, Ueber den Aufbau eines isomeren Narcotins (pp. 183-187). *Nencki, K.*, Ueber die Einwirkung von o-Aldehydosäuren auf Chinaldin bei Gegenwart von Chlorzink (pp. 187-190).

Jahrgang xxix. No. 2. (10th February, 1896.)

Schunck, E., und *Marchlewski, L.*, Zur Kenntniss des Isatins (pp. 194-203). *Von Lippmann, E. O.*, Bemerkung zur Frage ueber die Ursache der Birotation (pp. 203-204). *Scheitel, A.*, Darstellung der Salze der Platincyan-Wasserstoffsäure $Pt(CN)_4H_2$. (pp. 204-205). *Fischer, E.*, Neue Bildungsweise der Oxazole (pp. 205-214). *Zelinsky, N.*, und *Reformatzky, A.*, III. Untersuchungen in der Hexamethylenreihe (Synthese des Nononaphtens) (pp. 214-216). *Heffter, A.*, Ueber Cacteen-alkaloïde (pp. 216-228). *Kerp, W.*, Ueber Diphenylenketon und Pseudo-Diphenylenketon (pp. 228-233). *Bablich, A.*, und *v. Kostanecki, St.*, Ueber Oxybenzalacetophenone (pp. 233-237). *V. Kostanecki, St.*, und *Tambor J.*, Ueber α-Cumaryl-Phenylketon (pp. 237-240). *Cornelson, A.*, und *v. Kostanecki, St.*, Zur Einwirkung der Aldehyde auf Ketone (pp. 240-244). *V. Kostanecki, St.*, und *Oppelt, E.*, Ueber einige Derivate des 2-Oxy-benzalacetophenons (pp. 244-249). *Knorr, L.*, Ueber das Pyrazolon (pp. 249-260). *Bleier, O.*, Ueber gasanalytische Apparate (pp. 260-265). *Schöpf, M.*, Zur Constitutionsfrage der 2·3-Oxynaphtoësaure (pp. 265-270). *Schall, C.*, Ueber γ-Carbodiphenylimid (pp. 270-272). *Bamberger, E.*, und *Kraus, E.*, Ueber Thiodiazoverbindungen (pp. 272-287). *Schraube, C.*, und *Fritsch, M.*, Wanderungen der Diazogruppen (pp. 287-295). *Erlenmeyer, E.*, Zur Kenntniss der Diphenyloxäthylaminbasen (pp. 295-298). *Schiff, H.*, Biuret-reactionen (pp. 298-303). *Gabriel, S.*, und *Stelzner, R.*, Ueber (B, 3-) Methylindazol (pp. 303-310). *Klages, A.*, Ueber einige Derivate des m-Xylols (pp. 310-314). *Jünger, E.*, und *Klages, A.*, Ueber den Abbau des Menthols (314-318).

Band liii. No. 1. *Journal für praktische Chemie.* (3rd January, 1896.)

Otto, R., Ueber das Verhalten des Stilbendibromids und der Tolandibromide gegen benzolsulfinsaures Natrium und Natriumphenylmercaptid (1-19). *Rosdalsky, G.*, Ueber Abkömmlinge des Piperazins (pp. 19-25). *Claus, Ad.*, Meta-para- und Para-ana-Dibromchinolin (pp. 25-39). *Claus, Ad.*, und *Huth, M.*, Zur Kenntniss der Resorcin-Ketone (pp. 39-42). *Erdmann, H.*, und *Huth, P.*, Zur Kenntniss des Rhodinols oder Geraniols (pp. 42-47). *Vaubel, W.*, Ueber den Zusammenhang zwischen Farbe und Constitution der Triphenylmethanfarbstoffe (pp. 47-48).

Band xi. Heft 2 und 3. *Zeitschrift für Anorganische Chemie.* (25th Jan., 1896.)

Hempel, W., und *Thiele, H.*, Eine Atomgewichts bestimmung des Kobalts (pp. 73-106). *Piccini, A.*, Ueber die Alaune des Vanadintrioxydes. I. (pp. 106-116). *Peters, F.*, Einige Produkte, die durch Einwirkung von Blei und von Kaliumnitrit auf Bleinitrat entstehen (pp. 116-160). *Spring, W.*, Ueber den Einfluss der Zeit Auf das Zusammenschweissen gepresster Kreide (pp. 160-165). *Küster, F. W.*, Ueber die Reaktion zwischen Ferrisalzen und Jodiden in wässeriger Lösung (pp. 165-175). *Rosenheim, A.*, Ueber die Einwirkung anorganischer metallsäuren auf organische säuren. II. (pp. 175-223).

Band xix. Heft 1. *Zeitschrift für Physikalische Chemie.* (28th Jan., 1896.)

Storch, L., Ueber den Verlauf chemischer Reaktionen bei Gasen (pp. 1-13). *Storch, L.*, Ueber das Verdünnungsgesetz der Elektrolyte (pp. 13-20). *Eder, J. M.*, Bemerkungen zur Herrn C. Bohns Abhandlung: "Ueber Flammen und leuchtende Gase" (pp. 20-25). *Mond, L.*, *Ramsay, W.*, und *Shields, J.*, Ueber die Okklusion von Sauerstoff und Wasserstoff durch Platinschwarz I. (pp. 25-63). *Wildermann, M.*, Ueber die scheinbare und

wahre Gefriertemperatur und die Gefriermethoden (pp. 63-94). *Ratz, F.*, Ueber die Dielektrizitatskonstante von Flüssigkeiten in ihrer Abhängigkeit von Temperatur und Druck (pp. 94-113). *Nasini, R.*, und *Gennari, G.*, Anomalien in der Rotationsdispersion der Apfelsäure (pp. 113-130). *Gennari, G.*, Ueber die Rotationsdispersion des Nikotins und seiner Salze (pp. 130-135). *Müller-Erzbach, W.*, Die durch äussern Feuchtigkeitsdruck gemessene Zersetzungsspannung wasserhaltiger Salze und die Konstitution des gebundenen Wassers (pp. 135-155). *V. Schneider, B.*, Ueber die Schmelzpunkte einiger organischer Verbindungen (pp. 155-191).

Anno xxv. Vol. 2. Fascicolo 6. *Gazzetta Chemica Italiana.* (14th Jan., 1896.)

Leone, T., Sulla ricerca dell' acido nitrico per indiziare l'anacquamento dei vini (pp. 433-461). *Francesconi, L.*, Acido santonico e suoi derivati (pp. 461-478). *Tarugi, N.*, Esclusione del solfuro ammonico (4° gruppo) dall' analisi qualitativa (pp. 478-481). *Rebufatt, O.*, Teorie ed esperimenti sui cementi idraulici (pp. 481-494). *Angeli, A.*, e *Rimini, E.*, Sopra l'esodiazoacetofenone (pp. 494-497). *Purgotti, A.*, Azione dell' idrato d'idrazina sull' etere etilico di qualche nitrofenolo e sintesi della 2, 4, 6-trinitro metaetossi feniledrazina (pp. 497-505). *Cossa, A.*, Sui composti di platosomonodiammina (pp. 505-508). *Nasini, R.*, e *Anderline, F.*, Ricerca dell'argo nelle emanazioni terrestri I. Gas delle terme di Abano (pp. 508-509). *Piutti, A.*, Azione dell' acido succinico sopra il p-amidofenolo ed i suoi eteri (pp. 509-518). *Piutti, A.*, Azione del jodio sopra immidi ed immidi sostituite (pp. 518-527). *Castellaneta, E.*, Azione degli acidi ossalico e malonico sopra il p-amidofenol ed i soui eteri (pp. 527-542). *Piccini, A.*, Sugli allumi di sesquiossido di titanio (pp. 542-543).

APPENDIX I.

NOTICES OF BOOKS.

Die Spiele der Thiere. By Karl Groos. Jena: G. Fischer, 1896. Pp. xvi., 359.

The chief point which is worked out in this book is that animal play depends on a deeply planted instinct of the greatest importance in the struggle for existence. Spencer's view that play is the expression of overflow of energy is held to be only a small part of the truth. Play is regarded as the instinctive performance, without real cause, of actions resembling those useful in the actual struggle for life. Superfluous energy is the most favourable condition for play, but the author points out that the impulse to play is so strong that animals will react to a stimulus to play even when in an exhausted condition.

The second chapter contains a good account of the views which have been held on the subject of instinct, the author's own position being very close to that of Weismann. Play being regarded as an instinct, the play of young animals is naturally most fully considered. The importance of play is rated so highly that the author supposes that "youth owes its existence to the necessity for play". In the next two chapters, in which the games of animals are considered in detail, the author's views are illustrated by copious examples drawn from very wide sources, but chiefly from the accounts of those who have observed animals in a state of nature. One of the most quoted authors in this respect is Hudson. The simplest kind of play is called "experimenting," and this term is employed for the actions of young animals, by means of which they obtain command over their own movements and over external objects. Under the heading of play of movement are included most of the examples quoted by Spencer in support of his theory. Hunting and fighting games are fully considered, and they give strong support to the author's view. In considering such play as that of a cat with a caught mouse, strong objection is made to Romanes' view that animals delight in torture for torture's sake; such play is rather regarded as instinctive activity adapted to improve skill. Instances are given in which building and nursing appear to have occurred in play. Imitation games are considered, and imitation is regarded as an instinct closely associated with the play instinct.

The performances of courtships are considered separately, differing from other kinds of play in that they have a real occasion. The subject of sexual selection is fully discussed. The author is sceptical on the question of conscious choice by the female, and he thinks that there is distinct evidence that pairing takes place before the courtship performances begin. He regards it as necessary for the preservation of the species that there should be some restraint of the sexual act, and he supposes that this restraint is provided by instinctive coyness of the female, and that the performances are carried out in order to overcome this coyness by producing sexual excitement; coquetry is the result of the struggle of two opposed instincts. A full account is given of the various forms which these performances may take, and instances are given in which they have been observed in young animals.

In the final chapter the psychology of play is considered. The games of young animals are held to be purely instinctive, and their only mental accompaniment to be the pleasure attending the satisfaction of an instinct. In the adult animal it is believed that play is often accompanied by consciousness of the unreal nature of the activity, the chief element in this consciousness being the pleasure of power. Instances of dissimulation in animals are quoted in support of the existence of consciousness of sham-occupation. In conclusion, the relation of animal play to the various forms of art is dealt with, and this part of the subject will no doubt be more fully treated in another work on human play which is promised by the author.

Text-book of the Embryology of Invertebrates. By E. Korschelt and K. Heider. Translation into English by E. L. Mark and W. Mc. M. Woodworth, with additions by the Authors and Translators. Part I. London: Swan Sonnenschein & Co., Limited. New York: Macmillan & Co., 1895.

This volume of 466 pp., with 225 illustrations, has been eagerly awaited. The original is too familiar to those who read German to need comment here; suffice it to say that it deals in a lucid manner with the development of the Invertebrata, including the Enteropneusta and Rotatoria, with the exception of the Mollusca, Brachiostoma, and Arthropoda. Prof. Mark's

previous translations are so well known, and the work which for years has appeared under his direction in the *Bull. Mus. Comp. Zool.* at Harvard College has become so famous for the thoroughness of its bibliographical department, that the success of the present venture seemed assured in his hands.

The original is certainly the best general treatise on Embryology which has appeared since Balfour's, if indeed it is not in some respects preferable to that. With respect to the share taken by the translators in bringing it up to date, comparison arises with the senior translator's rendering of Hertwig's *Text-book of Embryology*, in which a similar resolve was made but very inefficiently carried out. Not so here; and in the selection of new matter, a wise discretion has been exercised in the presentation of novelties to the student mind, to wit, in the treatment of those observations tending towards the overthrow of the germ-layer theory. We note that due regard has been paid to the various modes of asexual reproduction and regeneration, a feature not always met with in works on Embryology; but, conversely, we regret that Chun's *Dissogonie* has not received the attention it deserves in the Chapter on the Ctenophora. And it is a distinctly healthy sign to read in a text-book of pure Embryology, apropos of Semon's "*Pentactula*" stage in Echinoderm development and a discussion of its possible bearings on Phylogany, that it seems "more justifiable to search for the ancestral forms of the Echinodermata among the existing material which is offered us by Palæontology".

Of the success of the translation and of the future of the book there can be no doubt. It is clear in style and in get up. All has been done with a due sense of proportion, and the few errors we have detected are such as will be self-evident to the intelligent reader. We can confidently recommend the work as the most generally serviceable on the subject in the English tongue.

The translators remark in their preface that they have been "compelled by the pressure of other duties to relinquish to others the task" of translation of the two remaining parts of the work. In this they have become notorious, for, loyal to an earlier suggestion of the senior translator, they have rendered "anlage" as "fundament"! The publishers announce that the translation will be continued by Dr. H. J. Campbell, a gentleman who has served them in a similar capacity on more than one occasion. We would remind him that in respect to the general translation here set before him he has an example which he may well emulate, and express the hope that in the interests of English he will not allow the afore-mentioned extraordinary misuse of so commonplace a word to continue.

Introduction to the Study of Fungi, their Organography, Classification, and Distribution for the use of Collectors. By M. C. Cooke, M.A., LL.D., A.L.S. London: Adam & Charles Black.

Perhaps there is no group of plants more bewildering to the beginner than that of the Fungi. The number of known species is enormous, probably more than 40,000, and the frequent occurrence of polymorphism serves considerably to complicate the task of understanding their mutual relationships. Most of the existing text- and hand-books, even though estimable enough in their way, only produce a feeling of discouragement in the mind of the student, since they practically presuppose a degree of acquaintance with the general forms of the plants such as the reader in most cases does not possess. Hence he has either to greatly extend the scope of his reading by referring to original papers and figures, or, too commonly, he is contented with merely "getting up" special facts about an organism of whose general character he does not possess the remotest idea.

The great merit of Dr. Cooke's book lies in the fact that it contains a good deal of description of entire plants. Probably no one possesses a more extensive knowledge of the external characters of Fungi than the author, and his account is frequently enlivened with interesting details of habit and mode of life. He divides the work up into three main sections, Organography, Classification, and Distribution, and in an appendix gives useful hints as to collecting and preserving specimens.

The subject of Organography is dealt with rather from the standpoint of the systematist than from that of the comparative morphologist, and although this method of treatment is of necessity somewhat formal the student will find that it possesses practical advantages of its own, inasmuch as it provides a useful key with which to unlock the vast storehouse of facts buried in the more purely systematic treatises. Naturally, there are several points on which there will be differences of opinion between the author and his readers, and the records of certain alleged observations whose accuracy has never been admitted by persons most qualified to judge, might well have been omitted. Probably, too, many will dissent from the author's

opinion that in "Hymenomycetal Fungi really parasitic species are almost if not wholly unknown".

In the introduction to the section on Classification, a sketch of the Brefeldian system is given, though it is not adhered to by Dr. Cooke in the subsequent chapters. We notice that the author still apparently retains the opinion that Lichens are to be regarded as a group distinct from Fungi on the one hand and from Algæ on the other, but no new arguments are brought forward to support a position which has been long ago abandoned by nearly all botanists.

Speaking generally, one rather misses in these chapters the feeling a real and natural relationship existing between the different groups, and in some instances, as in the Uredineæ and Ustilagineæ, there is no effort made to trace it. This is especially disappointing when one recollects the brilliant expositions of Brefeld and his disciples on these questions. But notwithstanding this defect—for as such we must regard it—there is a great deal of valuable matter in these pages which will not be readily found elsewhere.

The concluding section on Distribution contains some interesting facts and generalisations, and statistics are given as to the relative proportions in which the various groups are scattered over the earth's surface. Thus amongst the Hymenomycetes it would appear that the more fleshy species are chiefly restricted to temperate and cold climates, whilst the tough and leathery forms are more especially characteristic of the tropical regions.

The book is well illustrated with figures, and the copious bibliographies appended to the chapters greatly add to the value of a work which deserves to be widely appreciated, not only by "Collectors," for whose use it was more especially designed, but by all who are interested in these lower orders of plants.

Untersuchungen über die Stärkekörner. By Dr. A. Meyer. Jena: Fischer, 1895.

This is one of the most important and valuable monographs that have recently been published, treating as it does of a somewhat small section of botanical research, which has nevertheless been the subject of much controversy, and has been the subject of investigation and speculation by many writers of great technical skill and critical acumen. It includes a summary of the researches of previous observers, and is enriched by independent observations of the author.

The starch grain seems at first sight to offer but little scope for speculation, yet upon its structure many points of great importance hang, which touch indeed the physical construction of protoplasm itself, and that of the many organised structures derived from it.

Dr. Meyer treats very carefully of the chemistry and physics of the starch grain as well as of its biological peculiarities. He considers it to consist of at least two different bodies, which he calls *amyloses*, both of which are crystalline, though one of them cannot be made form isolated crystals. Besides these other substances sometimes occur, which are also carbohydrates, but which are only found when the grains have been somewhat modified. It is a pity, perhaps, that he has selected the term *amylose* for these two constituents, as the termination *-ose* is so generally in use for sugars of various composition.

Dr. Meyer holds that the crystalline substance is in the form of fine needles, to which he gives the name *trichites*, and these are arranged in the grain in a radiating form, producing sphere-crystals, which are differently constituted in the several layers of the grain. The various physical properties which the latter presents are of course consistent with this view of its structure. The absorption of water which can so easily be brought about by the action of weak alkalis, etc., is discussed at some length. In the author's opinion it is brought about by the actual taking up of water by the crystalline trichites, and not by its intercalation between them; we have therefore a view opposed to the older theory of the micellæ put forward so many years ago by Naegeli. Dr. Meyer does not, however, deny the possibility of water being taken up and held by whatever lies between the crystals.

The fate of the starch grain after its formation, the action of diastase upon it, and the many possible reactions leading to the appearance of the various dextrins are also very fully discussed. This section of the work in particular will be of great interest to all students of vegetable physiology.

In the chapters devoted to the formation and growth of the starch grain some new views are advanced which will perhaps not be readily accepted by other workers in this field. He supports very strongly Schimper's views of the action of the leucoplast, but he states that the formation of the grain is always inside the corpuscle. Though this has long been recognised as happening sometimes, it seems difficult to reconcile certain cases of not uncommon occur-

rence with it. Dr. Meyer, however, thinks the observations on which the view of excretion of starch substance beyond the plastid is based are defective, and that a thin layer of the latter always extends around the incipient and growing grain, although it needs very careful staining by approved methods to make it visible. He further extends the amyloplastic powers of the leucoplast and the chlorophyll grain to certain chromoplasts.

Besides these researches based upon the normal grains as commonly seen, the book contains some very valuable information upon the changes which the starch grain shows under many varied conditions, the differences noticeable at different seasons, and the alterations in it in the various organs of many different plants, taken from a very wide range in the vegetable kingdom. Many ingenious experiments are narrated bearing on many of these points. They are, however, of less general interest and indeed of less importance than the points of origin, structure and fate which have already been alluded to.

The work will have a great fascination for many workers in the field of vegetable physiology. It is a pity that the language in which it is written will cause it to be less generally useful to the English reader than its importance warrants.

APPENDIX II.

CHEMICAL LITERATURE FOR FEBRUARY, 1896.

Vol. i. No. 3. *American Journal of Science.* (March, 1896.)

Gooch, F. A., and *Peirce, A. W.*, Method for the Separation of Selenium from Tellurium based upon the difference in volatility of the Bromides (pp. 181-186). *Adams, F. D.*, and *Harrington, B. J.*, New Alkali Hornblende and a titaniferous Andradite from the Nepheline-Syenite of Dungannon, Hastings County, Ontario (pp. 210-219). *Penfield, S. L.*, and *Pratt, J. H.*, Occurrence of Thaumasite at West Paterson, New Jersey (pp. 229-234).

Vol. xviii. No. 3. *Journal of the American Chemical Society.* (March, 1896.)

Clarke, F. W., Third Annual Report of Committee on Atomic Weights. Results published during 1895 (pp. 197-214). *Johnson, S. W.*, Composition of Wood Gum (pp. 214-223). *Blair, A. A.*, Method for the Determination of Carbon in Steel (pp. 223-227). *Hopkins, C. G.*, A New Safety Distillation Tube for Rapid Work in Nitrogen Determinations (pp. 227-228). *Stone, G. C.*, Remarks on Mr. Auchy's Paper on the Volumetric Determination of Manganese (pp. 228-230). *Stone, G. C.*, Probable Production of Permanganate by Direct Combustion of Metallic Manganese (pp. 230-231). *Squibb, E. R.*, The Manufacture of Acetone and of Acetone-Chloroform from Acetic Acid (pp. 231-247). *Prescott, A. B.*, and *Baer, S. H.*, Pyridine Alkyl Hydroxides (pp. 247-251). *Andrews, L.*, On the Reduction of Sulphuric Acid by Copper, as a Function of the Temperature (pp. 251-254). *Wait, C. E.*, The Oxidation of Silver (pp. 254-259). *Wainwright, J. H.*, The Determination of the Solid Fat in Artificial Mixtures of Vegetable and Animal Fats and Oils (pp. 259-264). *Hazen, A.*, The Measurement of the Colours of Natural Waters (pp. 264-275). *Linton, L. A.*, Technical Analysis of Asphaltum, 2 (pp. 275-283).

Vol. xviii. No. 2. *American Chemical Journal.* (February, 1896.)

Wheeler, H. S., and *Walden, P. T.*, On Halogen Addition-Products of the Anilides (pp. 85-90). *Remsen, I.*, and *Norris, J. F.*, The Action of the Halogens on the Methylamines (pp. 90-95). *De Chalmot, G.*, On Silicides (pp. 95-96). *Norris, R. S.*, and *Cottrell, F. G.*, Some of the Properties of Liquid Hydriodic Acid (pp. 96-105). *Kastle, J. H.*, and *Bullock, J. H.*, On the Preparation of Hydrobromic and Hydriodic Acid (pp. 105-111). *Jackson, C. L.*, and *Warren, W. H.*, Turmerol (pp. 111-117). *Jackson, C. L.*, and *Dunlap, F. L.*, Certain Bromine Derivatives of Resorcine (pp. 117-133). *Jackson, C. L.*, and *Soch, C. A.*, Trinitrophenylmalonic Ester (pp. 133-141). *Mabery, C. F.*, and *Byerley, J. H.*, The Artificial Production of Asphalt from Petroleum (pp. 141-150). *Remsen, I.*, *Hartman, R. N.*, and *Muckenfuss, A. M.*, On the Action of Phosphorus Pentachloride on Parasulphaminebenzoic Acid (pp. 150-178).

Vol. xxi. No. 240. *The Analyst.* (March, 1896.)

Blount, B., The Determination of Oxygen in Commercial Copper (pp. 57-62). *Cribb, C. H.*, A New Form of Carbonic Acid Apparatus (pp. 62-64).

Vol. lxix. No. 400. *Journal of the Chemical Society.* (March, 1896.)

Henderson, J., Action of Sugars on Ammoniacal Silver Nitrate (pp. 145-154). *Tilden, W. A.*, and *Barnett, R. E.*, The Molecular Weight and Formula of Phosphoric Anhydride and of Metaphosphoric Acid (pp. 154-161). *Bentley, W. H.*, *Haworth, E.*, and *Perkin, W. H., Jun.*, On γ-Phenoxy-Derivatives of Malonic Acid and Acetic Acid, and Various Compounds used in the Synthesis of these Acids (pp. 161-175). *Haworth, E.*, and *Perkin, W. H., Jun.*, Note on the Preparation of Glycol (pp. 175-177). *Luxmoore, C. M.*, The

Oximes of Benzaldehyde and their Derivatives (pp. 177-193). *Walker, J.*, and *Appleyard, J. R.*, Transformation of the Alkylammonium Cyanates into the corresponding Ureas (pp. 193-206). *Perkin, A. G.*, Luteolin, I. (pp. 206-212). *Hutchinson, A.*, and *Pollard, W.*, Lead Tetracetate and the Plumbic Salts (pp. 212-226). *Lewes, V. B.*, The Acetylene Theory of Luminosity (pp. 226-243).

Vol. xv. No. 2. *Journal of the Society of Chemical Industry*. (29th Feb., 1896.)

Lovibond, J. W., The Effect of Lime Salts on Hop Infusions (pp. 71-75). *Reid, W. F.*, The Manufacture of Linoleum (pp. 75-79). *Irwin, W.*, The Effect of Heat on the Illuminating Power of Coal-Gas. Its Relation to the Theory of Flame (pp. 80-81). *Davis, G. E.*, Photography by the Röntgen Rays (p. 82). *Barnes, J.*, On the Estimation of Organic Matter by Means of Chromic Acid (pp. 82-84). *Archbutt, L.*, Note on the Ignition of Sawdust by Nitric Acid (pp. 84-85). *Archbutt, L.*, Note on an Experiment made to Determine the Pressure of Ether and some other Volatile Liquids in Closed Vessels (pp. 85-86). *Cohen, J. B.*, and *Russell, G. H.*, The Combustion of Coal and Gas in House Fires (pp. 86-90). *Mackey, McD. W.*, Apparatus for the Determination of the Relative Liability to Spontaneous Combustion of Oils spread on Cotton Wool (pp. 90-91). *Dott, D. B.*, Opium Assay (pp. 91-94). *Gane, E. H.*, The Determination of Caffeine in Tea (pp. 95-96). *Edwards, H. W.*, Bessemerizing Nickel Matte (pp. 96-99). *Peacock, S.*, American Phosphates in 1895 (p. 99).

Vol. xli. No. 250. *Philosophical Magazine and Journal of Science.* (March, 1896.)

Nernst, W., and *Abegg, R.*, On the Freezing-points of Dilute Solutions (pp. 96-199).

Tome vii. *Annales de Chimie et de Physique.* (March, 1896.)

Perreau, F., Etude expérimentale de la dispersion et de la réfraction des gaz (pp. 289-348). *Sabatier, P.*, et *Senderens, J. B.*, Recherches sur les oxydes de l'azote, oxyde azotique, oxyde azoteux, peroxyde d'azote (pp. 348-416). *Lescoeur, H.*, Recherches sur la dissociation des hydrates salins et des composés analogues (pp. 416-432).

Tomes xv.-xvi. No. 4. *Bulletin de la Société Chimique de Paris.* (20th February, 1896.)

Guye, P. A., et *Chavanne, L.*, Etude sur la dissymétrie moléculaire : Recherches sur le pouvoir rotatoire des corps actifs homologues (pp. 177-195). *Tanret, C.*, Sur les modifications moléculaires et la multirotation des sucres (pp. 195-205). *Tassily*, Sur les iodures cristallisés de strontium et de calcium (pp. 205-206). *Varet, R.*, Recherches sur les cyanures de lithium, de magnésium, de cuivre (pp. 206-208). *Senderens, J. B.*, Nouvelles recherches sur les précipitations métalliques (pp. 208-221). *Iovitschtch, M.*, Contribution à la connaissance de la stéréoisomérie que présente l'éther isonitrosoacétylacétique (pp. 221-227). *Arth, G.*, Action de l'isocyanate de phényle sur l'acide γ-pimélique dérivé du menthol (pp. 227-229). *Reverdin, F.*, et *Kauffman, H.*, Sur quelques produits de substitution des carbonates et phosphates d'α et de β-naphtyle et sur la préparation du chloronaphtol $C_{10}H_6OH$. Cl. (1.4) et du bromo naphtol $C_{10}H_6OH$. Br (1.4) (pp. 229-235). *Bietrix, A.*, Sur une matière colorante dérivée de l'acide dibromogallique (pp. 235-236). *Lasne, H.*, Sur le dosage de l'aluminium dans les phosphates (iii.) (pp. 237-248). *Béchamp, A.*, Sur les altérations spontanées du lait et sur celles que la cuisson lui fait subir (pp. 248-272).

Tomes xv.-xvi. No. 5. (5th March, 1896.)

Tassilly, Appareil pour filtrer ou essorer les corps altérables à l'air (pp. 274-275). *Guye, P.*, et *Chavanne, L.*, Etude sur la dissymétrie moléculaire : Recherches sur le pouvoir rotatoire des corps actifs homologues (pp. 275-305). *Guye, P. A.*, et *Jordan, C.*, Formule simplifiée pour calculer les variations de densité des liquides avec la température (pp. 306-309). *Thomas, V.*, Action du peroxyde d'azote sur les sels halogénés d'etain (persels) (pp. 309-

315). *Racoura, A.*, Sur un nouvel acide du chrome, l'hydrate sulfochromique (pp. 315-321). *Trillat, A.*, Préparation des amines de la série grasse (pp. 321-322). *Perrir, G.*, Sur la propylnaphtylcétone β (pp. 322-324). *Haller, A.*, Synthèse partielle du camphre (pp. 324-327). *Rosenstiehl, A.*, Sur quelques réactions propres aux fuchsines et aux carbinols amidés (pp. 327-330).

Tome cxxii. No. 6. *Comptes Rendus hebdomadaires de l'Académie des Sciences.* (10th February, 1896.)

Moissan, H., Etude du carbure d'uranium (pp. 274-280). *Haller, A.*, Sur la campholide, produit de réduction de l'anhydride camphorique (pp. 293-298). *Vigouroux*, Sur le siliciure de cuivre (pp. 318-320). *Besson, A.*, Sur le chlorobromure et le bromure de thionyle (pp. 320-322). *Granger, A.*, Sur un sulfophosphure d'étain cristallisé (pp. 322-323). *Tassilly*, Oxyiodures de zinc (pp. 323-325). *Brulle, R.*, Méthode pour déterminer la pureté des beurres au moyen de la densité (pp. 325-326).

Tome cxxii. No. 7. (17th February, 1896.)

Moissan, H., Préparation et propriétés du carbure de cérium (pp. 357-262). *Moissan, H.*, Sur le carbure de lithium (pp. 362-364). *Engel, R.*, et *Bernard, J.*, Sur un procédé rapide de dosage de l'arsenic (pp. 390-393). *Barbier, P.*, et *Bouveault, L.*, Synthése partielle de l'acide géranique; constitution du lémonol et du lémonal (pp. 393-395). *Gassmann, C.*, Sur quelques dérivés de l'eugénol (pp. 395-398). *Schloesing, T., fils*, Sur la composition du grisou (pp. 398-401).

Tome cxxii. No. 8. (24th February, 1896.)

Moissan, H., Sur le carbure de manganèse (pp. 421-424). *Moissan, H.*, Etude des borures de nickel et de cobalt (pp. 424-426). *Gautier, A.*, Sur le dosage de l'arsenic (pp. 426-428). *Haller, A.*, Sur la transformation de l'acide camphorique droit en camphre droit; synthese partielle du camphre (pp. 446-449). *Carnot, A.*, Analyse, par les procédés volumétriques, d'un mélange de chlorures, d'hypochlorites et de chlorates (pp. 449-452). *Carnot, A.*, Analyse d'un mélange de chlorures, de chlorate et de perchlorates (pp. 452-454). *Besson, A.*, Action de quelques composés hydrogénés sur le chlorure de sulfuryle (pp. 461-469). *Barillot, E.*, Sur le rendement des diverses essences de bois en charbon, alcool méthylique et acide acétique (pp. 469-471). *Chesneau*, Sur la température des étincelles produites par l'uranium (pp. 471-473). *Marie, C.*, et *Marquis, R.*, Sur un nouveau mode de formation des nitroprussiates (pp. 473-474). *Baugé, G.*, Sur un carbonate chromeux ammoniacal cristallisé (pp. 474-477). *Mouren, C.*, Sur la vératrylamine (pp. 477-480). *Rivals, P.*, Etude thermochimique de l'acide orthochlorbenzoïque et de quelques-uns de ses dérivés (pp. 480-482). *Trillat, A.*, Transformation de la solution de formaldéhyde en vapeurs pour la désinfection (pp. 482-483).

Tome cxxii. No. 9. (2nd March, 1896.)

Barbier, P., et *Bouveault*, Extraction du rhodinol, de l'essence de pélargonium et de l'essence de roses; identité de ces deux alcools (pp. 529-531). *Combes, C.*, Sur la préparation du silicichloroforme, du silicibromoforme et sur quelques dérivés du triphényl-silico-protane (pp. 531-533). *Charon, E.*, Oxydation de l'aldéhyde crotonique (pp. 533-535).

16e Année. Tome iii. No. 4. *Journal de Pharmacie et de Chimie.* (15th February, 1896.)

Cazeneuve, P., Note sur un nouvel outillage pour conserver les viandes par cuisson et élimination d'air (pp. 169-171). *Marie, T.*, Ethers glycériques des acides cérotique et mélissique (pp. 171-177). *Bourquelot, E.*, et *Bertrand*, G., Sur la coloration des tissus et du suc de certains champignons au contact de l'air (pp. 177-182). *Barthe, L.*, L'oxycyanure de mercure (pp. 182-184).

16e Année. Tome iii. No. 5. (1st March, 1896.)

Colson, A., Sur un type d'allumettes non toxiques (pp. 225-228). *Gorges*, Dosage de l'iode dans l'huile de foie de morue (pp. 228-229). *François, M.*, Sur le protoiodure de mercure

(pp. 229-233). *Gerard, E.*, Sur le dédoublement de l'Amygdaline dans l'economie (pp. 233-236). *Lafay, L.*, Quelques faits relatifs à la pharmacologie du benzoate de soude (pp. 236-242).

Tome xxvii. No. 9. *Journal de la Société Physico-Chimique Russe.*

Kischner, N., Sur les amines et les hydrazines de la série polyméthylènique (pp. 521-553). *Selivanoff, T.*, Action des acides hypochloreux et hypobromeaux sur l'iodure de potassium (pp. 553-568). *Reformatsky, S.*, et *Pleskonosoff, W.*, Action du zinc sur l'éther bromoisobutyrique en présence de l'acétone (pp. 568-577). *Tichvinsky, M.*, Benzylrosinduline et benzylrosindulone (pp. 577-584). *Godlevsky, J.*, Oxydation du limonène; *Wagner, G.*, Méthodes pour déterminer la structure des olefines; *Wagner, G.*, Sur le formation simultanée des éthers nitreux et des combinaisons nitrées; *Ertchikoffsky*, Action de l'acide acètique sur le pinène eu présence du chlorure de zinc; *Ginsberg, A.*, La dehydratation du trioxyhexahydrocymène; *Petrenko-Kritchenko*, Action de la phenylhydrazine sur les éthers acetodicarboniques; *Charitschkoff, K.*, Sur la naphte de l'ile de Tcheleken; *Jakovkine, A.*, Sur la division d'une substance entre deux dissolvants; *Reformatsky, S.*, Formation de l'acide diméthylglutarique; *Daine*, Synthèse de l'acide phényloxypivalique; *Andres, L.*, Synthèse de l'acide éthylphényllactique; *Cuculesco, I.*, Sur l'acide diméthylisobutyllactique; *Zelinsky, D.*, Sur le triméthylhexamethylène (pp. 584-602).

Band ccxxxiv. Heft 1. *Archiv de Pharmacie.* (2nd January, 1896.)

Gadamer, J., Ueber das Thiosinamin II. (pp. 1-48). *Boettinger, C.*, Ueber einige Abkömmlinge der Sulfometabrombenzoësäure (pp. 48-55). *Dragendorff, G.*, Beiträge zur gerichtlichen Chemie (pp. 55-80). *Gadamer, J.*, Berichtigung (p. 80).

Band ccxxxiv. Heft 2. (22nd February, 1896.)

Dragendorff, C., Beiträge zur gerichtlichen chemie (pp. 81-87). *Boettinger, C.*, Ueber einige Abkömmlinge des Acetessigäthers (pp. 87-91). *Boettinger, C.*, Ueber glyoxylsaures Natrium (pp. 91-92). *Virchow, H.*, Ueber Bau und Nervatur der Blattzähne und Blattspitzen (pp. 92-154). *Lutz, G.*, Ueber die oblito-schizogenen Secretbehälter der Mystaceen (pp. 154-158). *Boettinger, C.*, Ueber einige Abkömmlinge der Glykolsäure (pp. 158-160).

Jahrgang xxix. No. 3. *Berichte der Deutschen Chemischen Gesellschaft.* (24th February, 1896.)

Fischer, E., Krystallisirte wasserfreie Rhamnose (pp. 324-325). *Hsese. O.*, Notiz ueber die Wurzel von Rumex napalensis (pp. 325-326). *Baeyer. A.*, Ortsbestimmungen in der Terpenreihe (pp. 326-329). *Eckenroth, H.*, und *Klein, K.*, Ueber die Einwirkung einiger sauerstoffhaltiger Halogenverbindungen auf Benzoësäuresulfinidnatrium (Saccharin) (pp. 529-333). *Zelinsky, N.*, und *Tschernoswitow, N.*, Ueber stereoisomer Dimethyltricarballylsäuren (pp. 333-340). *Clever, A.*, und *Muthmann, W.*, Untersuchungen ueber den Schwefelstickstoff (pp. 340-343). *Tiemann, F.*, Bemerkung (pp. 343-344). *Hell, C.*, und *Gaab, C.*, Ueber Derivate des Isoanethols (pp. 344-352). *Schulze, E.*, Ueber das Vorkommen von Arginin in den Knollen und Wurzeln einiger Pflanzen (pp. 352-356). *Sommer, E. A.*, Ueber α- und β-Styrolnitrosit (pp. 356-361). *Fischer, O.*, und *Hepp, E.*, Nachträge zur Kenntniss der Induline und Safranine (pp. 361-372). *Koenigs, W.*, Ersetzung von Hydroxyl in Chinaalkaloïden durch Wasserstoff. II. (pp. 372-375). *Harries, C.*, und *Busse, G.*, Ueber Reduction einiger ungesättigter aromatischer Ketone und ihre Ueberführung in Cumaranderivate (pp. 375-380). *Harries, C.*, und *Eschenbach, G.*, Ueber Reduction ungesättigter Ketone (pp. 380-389). *Willstätter, R.*, Ueber einige Derivate der Pipecolinsäure (pp. 389-393). *Willstätter, R.*, Ueber das Tropinon (pp. 393-403). *Zelinsky, N.*, und *Rudsky, M.*, Synthetische Versuche in der Pentamethylenreihe (pp. 403-405).

Jahrgang xxix. No. 4. (9th March, 1896.)

Herty, C. H., Ueber gemischte Haloïde des Platins und Kaliums (pp. 411-414). *Jaubert, G. P.*, Beiträge zur Nomenclatur der Farbstoffe der Phenazinreihe (pp. 414-418).

Beckmann, E., und *Eickelberg, H.*, Zur Kenntniss der Menthone, Ueberführung in Thymol (pp. 418-421). *Ladenburg A.*, Zur Constitution des Tropins (pp. 421-422). *Ladenburg, A.*, Ueber das Isopipecolin (pp. 422-424). *Krafft, F.*, und *Lyons, R. E.*, Ueber Diphenylselenon $C_6H_5 . SeO_2 . C_6H_5$ (pp. 424-428). *Krafft, F.*, und *Kaschau, A.*, Ueber die Synthese der aromatischen Selenverbindungen vermittels Chloraluminium (pp. 428-435). *Krafft, F.*, und *Lyons, R. E.*, Ueber Thianthren (Diphenylendisulfid) $C_{12}H_8S_2$ und Selenanthren. I. (pp. 435-443). *Krafft, F.*, und *Kaschau, A.*, Ueber Thianthren und Selenanthren, $C_{12}\ H_8\ Se_2$. II. (pp. 443-446). *Bamberger, E.*, Experimentalbeiträge zur Chemie der Diazoverbindungen (pp. 446-474). *Van Erp, H.*, Ueber die Wirkung von schmelzendem Kali auf Methylnitramin und Dimethylnitramin (pp. 474-476). *Bondzynski, St. von*, Ueber das Cholesterin der menschlichen Faeces (pp. 476-478). *Euthyme* und *Klinienko, B.*, Ueber die Reaction der unterchlorigen Säure mit Chlorkobalt und Chlormangan (pp. 478-481). *Ciamician, G.*, und *Silber, P.*, Ueber die Alhaloïde der Granatwurzelrinde (pp. 481-490). *Ciamician, G.*, und *Silber, P.*, Ueber das n- Methyltroponin (pp. 490-494). *Wislicenus, H.*, Glatte Reduction der Nitrogruppe zur Hydroxylamingruppe (pp. 494-496). *Pschorr, R.*, Neue Synthese des Phenanthrens und seiner Derivate (pp. 496-501). *Meyenburg, F. v.*, Ueber die Einwirkung von Chlorkohlenoxyd auf Dimethyl- und Diäthyl- m- aminophenol (pp. 501-513). *Harries, C.*, und *Loth, G.*, Zur Constitution der 1- Phenyl- pyrazolone (pp. 513-521). *Harries, C.*, Ueber die Oxime der cyclischen Acetonbasen und das p- Aminotrimethylpiperidin (pp. 521-529). *Tiemann, F.*, und *Semmler, F. W.*, Ueber Pinonsäure (pp. 529-544). *Jnuger, E.*, und *Klages, A.*, Ueber Halogenderivate des Camphens und Hydrocamphens (pp. 544-547). *Lawrence, W. T.*, Ueber Verbindungen der Zucker mit dem Aethylen-, Trimethylen- und Benzylmercaptan (pp. 547-552). *Kraemer, G.*, und *Spilker, A.*, Ueber das Cyclopentadien im Steinkohlentheer, das Inden der Fettreihe (pp. 552-561).

Band liii. Nos. 2-3. *Journal für praktische Chemie.* (1st February, 1896.)

Thudichum, J. L. W., Ueber das Phrenosin, ein unmittelbares Educt aus dem Gehirn und die Producte seiner Chemolyse mit Salpetersäure (pp. 49-91). *Zincke, T.*, und *Helmert, B.*, Zur Constitution der Azimide (pp. 91-100). *Zincke, T.*, Ueber die Umwandlung von Bromprotocatechusäure in eine Dibrom- o- Naphto- Chinoncarbonsäure (pp. 100-106). *Claus, A.*, und *Schnell, L.*, p- Nitrochinolin und p- Amidochinolin (pp. 106-127). *Knorr, L.*, Erwiderung auf die Abhandlung von R. von Rothenburg: Isomeriefälle in der Pyrazolreihe (Herm. L. Knorr zur Antwort) (pp. 127-132). *Walter, J.*, Druckrohr für Laboratoriumsversuche (pp. 132-139). *Schall, C.*, Ueber γ-Carbodiphenylimid (pp. 139-143). *Lottermoser, A.*, Zur Kenntniss der Einwirkung von Natruim auf aromatische Nitrile IV. (pp. 143-144).

Band xvi. Heft 10. *Monatshefte für Chemie und verwandte Thiele anderer Wissenschaften.* (31st January, 1896.)

Glücksmann, C., Zur Bildung des Pinakolins aus Calcium iso-butyrat (pp. 897-906). *Herzig, J.*, Ueber Haematoxylin und Brasilin III. (pp. 906-919). *Kostanecki, St. v.*, und *Tambor, J.*, Ueber einen weiteren synthetischen Versuch in der Gentisinreihe (pp. 919-927).

Band xi. Heft 10. *Zeitschrift für Anorganische Chemie.* (20th February, 1896.)

Rosenheim, A., Ueber die Einwirkung organischer Metallsäuren auf organische Säuren (pp. 225-249). *Gooch, F. A.*, und *Peirce, A. W.*, Jodometrische Bestimmung der selenigen Saüre und der Selensäure (pp. 249-254). *Reizenstein, F.*, Ueber einige Metallsalze mit organischen Basen II. (pp. 254-264). *Flawitzky, F.*, Ueber eine Funktion, welche der Periodizität der Eigenschaften der chemischen Elemente entspricht (pp. 264-268). *Mawrow, F.*, und *Muthmann, W.*, Zur quantitativen Bestimmung und Scheidung des Kupfers (pp. 268-272). *Arctowski, H.*, Untersuchungen ueber die Löslichkeit beim Erstarrungspunkte der Lösungsmittel (pp. 727-28). *Hofmann, K. A.*, Ueber das Nitroprussidnatrium (pp. 278-288). *Hofmann, K. A.*, und *Wiede, O. F.*, Neue Darstellungsmethoden des Phenylesters der Eisentetranitrososulfosaüre (pp. 288-293).

Band xix. Heft 2. *Zeitschrift für Physikalische Chemie.* (25th February, 1896.)

Linck, G., Beitrag zu den Beziehungen zwischen dem Krystall und seinem chemischen Bestand (pp. 193-201). *Ortloff, W.*, Beitrag zur Kenntnis eutropischer Reihen (pp. 201-228). *Bredig, G.*, Ueber Wärmeleitung und Ionenbewegung (pp. 228-233). *Wildermann, M.*, Experimenteller Beweis der van't Hoffschen Konstante, des Arrheniusschen Satzes, des Ostwaldschen Verdünnungsgesetzes, des Daltonschen Gesetzes u. s. w. in sehr verdünnten Lösungen (pp. 233-251). *Zanninovich-Tessarin, H.*, Elektrolytische Dissociation der Lösungen in Ameisensäure (pp. 251-261). *Le Blanc, M.*, und *Rohland, P.*, Ueber den Einfluss, welchen die elektrolytische Dissociation, der Wechsel des Aggregatzustandes und des Lösungsmittels auf das Lichtbrechungsvermögen einiger Stoffe Ausüben (pp. 261-287). *Hertlein, H.*, Beiträge zur Kenntnis der Polythionate (pp. 287-318). *Van, Laar, J. J.*, Zur Antwort an Herrn Prof. W. Nernst (pp. 318-323). *Rodger, J. W.*, und *Watson, W.*, Ueber die magnetische Drehung der Polarisationsebene des Lichtes in Flüssigkeiten. I., Teil: Schwefelkohlenstoff und Wasser (pp. 323-380).

APPENDIX I.

NOTICES OF BOOKS.

The Cambridge Natural History, vol. v., "Peripatus," by Adam Sedgwick; "Myriapods," by F. G. Sinclair; "Insects," by D. Sharp. 8vo, pp. xi. and 584. London: Macmillan & Co., 1895.

We were told in the prospectus that "*The Cambridge Natural History* is intended, in the first instance, for those who have had no special scientific training, and who are not necessarily acquainted with scientific language". Mr. Sedgwick's chapter on Peripatus in the present volume gives a very curious interpretation to this intention. This chapter is, to a large extent, written in language which is nothing if not scientific, and which, however clear and intelligible to the well-versed student, must, at times, be completely mystifying to the untutored. Except in a few pages, where in simple words he describes the living Peripatus and its habits and external features, the style of his writing is much better suited to a scientific monograph or a text-book of comparative zoology. Here is a sample of it, taken from the section on development. "The segmentation is peculiar, and leads to the formation of a solid gastrula, composed of a cortex of ectodermal nuclei surrounding a central endodermal mass, which consists of a much-vacuolated tissue with some irregularly shaped nuclei. The endoderm mass is exposed at one point—the blastopore (gastrula mouth). The central vacuoles of the endoderm now unite and form the enteron of the embryo." The anatomy of Peripatus is somewhat similarly treated of in another section. These two sections, the most important in the chapter, will, no doubt, give pleasure to those readers who already possess some knowledge of the subjects, and to those who do not they may prove an incentive to go through a course of special training. Some excellent figures are scattered through the chapter, and there is a map to show the geographical distribution of the genus. A list of species, with their localities, is appended, and some of the species are briefly characterised. This list. or synopsis as it is called, may be useful to some readers, but for the systematic student it will have little value, as Mr. Sedgwick has apparently not taken the trouble to bring it up to date, and it differs in no essential respect, so far as we can judge, from one which he published with his monograph several years ago.

Mr. Sinclair tells us in his chapter on the Myriapods that he "only aims at giving an outline sketch of the group that shall be intelligible to the general reader who has not made a special study of such matters". In this aim he has, to some extent, succeeded very well. But this is not all that we were led to expect. For did not the prospectus also say that "an attempt would be made, not only to combine popular treatment with the latest results of scientific research, but to make the volumes useful to those who may be regarded as serious students of the various subjects"? We do not wish to imply that Mr. Sinclair has not made such an attempt. Evidence of it is in fact to be found in those parts of the chapter in which he writes on subjects with which his own researches have been particularly associated, but we find very few traces of it elsewhere. His general introduction, in which he speaks of the habits of Myriapods, is good, and his account of the structure and development of some of the groups leaves nothing to be desired. But when we turn to his treatment of classification and his account of some of the smaller but not less interesting orders there is a different tale to tell. Mr. Sinclair is apparently unaware that the whole subject of the classification of Myriapods has in recent years been completely revised, and his own attempt at classification is a mere revival of the antiquated system of Koch, with the addition of the two orders Symphyla and Pauropoda. Pocock and Kingsley, to mention two only of the chief authorities, will scarcely feel flattered to find that there is not the slightest reference to their views published several years ago, and not yet so far as we know disputed, that the so-called Myriapods do not constitute a single homogeneous class but consist of least two very distinct groups. We do not feel competent to follow Mr. Sinclair through his detailed accounts of the different orders, but if his treatment of the Symphyla may be taken as a sample of the rest, his performance in this respect is very poor indeed. Scolopendrella, the sole genus of this order, shows certain points of resemblance to the Thysanura, and is by some considered to be the living type which comes nearest to the ancestral forms of both Myriapods and Insects. Mr. Sinclair very properly calls

attention to the special interest which thus attaches to it, but how does he proceed to satisfy the desire for more detailed information? He gives no figure of the genus, and as to the number of species or as to the habits or habitat of any one of them, although two species are, we believe, common enough in this country, he says not a word. He points out it is true how Scolopendrella differs from Campodea, but in what respects it exhibits "a great resemblance to the Thysanura" he forgets to mention. We are told in one place that it has a pair of legs to each segment of the body, and in another that the smaller segments do not bear legs. The caudal appendages are described as hook-like, but why they should appear so to Mr. Sinclair and not to others we need not stop to inquire. The genital opening of Scolopendrella, he tells us, is on the last segment of the body, though he gives no reason for refusing to accept the statements of Ryder, Grassi, Haase and others, who tell us on the contrary that this opening is on the fourth segment. There is of course no reference to the remarkable coxal spurs and saccules of Scolopendrella; such matters being perhaps considered outside the interest of the general reader. As the volume is mainly entomological and intended as well for serious students, a fuller treatment of these structures would not we think be altogether out of place. In other parts of the chapter we notice a few inaccuracies which might with ordinary care have been avoided. Thus we read on p. 59 that "the generative system of Chilopoda differs chiefly in the opening of the genital apparatus at the end of the body instead of in the third segment; though this difference only separates the order from the Chilognatha and not from the other orders". The natural inference from this statement is that in all the other orders the genital opening is at the end of the body, but this is true only of the Schizotarsia. Again on p. 43 it is stated that the genital organs of the Chilognatha open on "one of the anterior rings of the posterior part of the body, usually the seventh". But this palpable slip is corrected in another place. Mr. Sinclair's references to Cuvier on page 77 we must also attribute to carelessness, for he could scarcely be so ill acquainted with the history of his subject as not to know that it was Latreille and not the great anatomist "who united the Myriopods with the Insects, making them the first order and the Thysanura the second," and who was thus the first to "claim a close relationship" between the two groups.

Dr. Sharp's Chapters on the Insects fill more than 500 of the whole 584 pages in the volume. They cover only a part of his subject, which is to be continued in another volume entirely devoted to the purpose. When we consider the vast extent of entomological literature and the number and variety of workers who have been engaged on this branch of science, it must be admitted that to write such an account of Insects as shall embrace all the most valuable and most generally interesting facts and shall at the same time be free from serious errors is by no means an easy task, and requires the exercise of considerable knowledge and judgment. The success with which Dr. Sharp has so far accomplished this task is not surprising to those who know him, but is not the less a matter for congratulation to himself as well as to his readers. His work is in most respects brought well up to date, and puts the reader in touch with nearly all the latest researches in every branch of Entomology, while for the student who wishes to follow up any particular subject copious references to original memoirs are supplied. Dr. Sharp is generally very guarded, almost too guarded in his statements, appearing throughout as the impartial recorder rather than as the exponent of any particular views, and seldom giving expression to his own opinion even on matters on which it might be expected to carry much weight. He refers for example without any comment to the suggestion that the elytra of beetles are homologous with the tegulæ and not with the anterior wings of other insects, though we have good reason to know that he himself holds the opposite view. Occasionally, however, he betrays some indication of his leanings. Thus on the subject of insect-vision he seems to hold with those who believe that insects perceive only "the lights, shades, and movements of the external world," and can distinguish neither form nor colour. He does not state this explicitly, but such is the inference we draw from the few remarks he makes on this interesting subject. We notice too that in describing the structure of the compound eye he omits all reference to the view long ago expressed by Straus-Durckheim and recently revived by Van Patten, that the crystalline cones are really percipient and not merely dioptric elements of the eye. Dr. Sharp's writing is generally very clear, but there are one or two places in which he leaves us in some doubt as to the drift of his remarks. From what he says on p. 89 he seems to admit the probability that in different insects the head is composed of a different number of primary segments, from three to six or even possibly seven, and that the "thorax" also may in some insects be composed of six and in others of three primary segments. Again in a footnote on p. 91, he speaks of the wings as "appendages" which "differ but little in their nature from legs". If he really holds the remarkable views which seem to be implied by his words in both these cases, we should like him to have stated them a little more clearly. One

or two other points in his account of the structure of insects call for some slight notice. "Comparison," he says, "suggests that the hypoglottis of Coleoptera may possibly represent the piece corresponding to the mentum of Orthopterists, the so-called mentum of beetles being in that case the sub-mentum of Orthopterists". This suggestion agrees very well with the statements appearing in so many text-books of comparative anatomy, in which the sub-mentum of Orthoptera is treated as part of the lower lip, and it seems to be supported by the figure which Dr. Sharp gives of the mouth parts of Locusta. But this figure is we fancy not altogether accurate. Comparison really seems to show that entomologists generally are right in regarding the sub-mentum of Orthoptera as part of the head, and homologous with the sub-mentum of beetles. This at least is the view which Waterhouse has taken[1] after instituting a series of very careful comparisons. Entomologists, however, are not always consistent in their use of anatomical terms, and we fancy we see an illustration of the fact in Dr. Sharp's use of the term clypeus. For what he figures and describes as the clypeus in the case of the cricket's head, does not seem to correspond with that part of the head of the cockroach which he denotes by the same name. This is, however, a minor point, and in a writer of less general accuracy than Dr. Sharp would probably escape notice altogether. There are a few omissions which had they been supplied would have added to the value of some of the chapters. In his general account of the embryonic development of insects, he says nothing about the post-oral origin of the antennae or of the appearance of leg-rudiments on the abdomen. His account of the Thysanura, remarkably full in other respects, is deficient in information about the interesting character of the mouth-parts, which is all the more to be regretted as it has so much bearing on the suggestion, to which in another place he refers, that the hypopharynx or rather the lobes at its base represent an additional pair of mouth-appendages. The least satisfactory part of Dr. Sharp's work is perhaps that in which he deals with the general classification of insects. Here he discusses the different systems proposed, and shows what every one is ready to admit that none of them is perfect, while at the same time he endeavours to excuse himself for reverting to one of the oldest and least natural of all. With his treatment of the different orders, which in this volume include the Aptera, Orthoptera, Neuroptera and a portion of the Hymenoptera we have no fault to find. He really seems to discount his own views on classification by the care with which he points out the close affinities between many of the groups of Pseudoneuroptera and the true Orthoptera. The work is excellently illustrated, and besides being full of interest for the general reader will prove extremely useful to the student. It promises to be when completed the best modern text-book of Entomology in the English language.

Grundzuge der Marinen Tiergeographie; Anleitung zur Untersuchung der geographischen Verbreitung Mariner Tiere, mit besonderer Berücksichtigung der Dekapodenkrebse. Von Dr. Arnold E. Ortmann in Princeton, N.J., U.S.A. Mit 1 Karte. Jena, 1896. 96 pp.

Dr. Arnold Ortmann's clever essay is principally concerned with the distribution of marine animals, objects with which his own studies have made him especially familiar. But he here only uses them to illustrate the general principles which he desires to commend to the student of distribution.

In a useful historical summary he sets forth the successive attempts that have been made to explain or to describe the real or supposed distribution of animals now living on the globe. At the outset it was not unnatural to fancy that the range of animal groups would be determined by the zones of temperature. A striking personality like the polar bear for instance is not met with in the tropics, nor are there any arctic or antarctic monkeys, and in the ocean reef-corals will not support a temperature below 66° F. For the division of the zones into regions and subregions, various zoologists selected the range of some particular species or group with which they happened themselves to be best acquainted. But the typical species sometimes turns out to represent nothing but itself, and in the mapping out of provinces and districts there is no security that the boundaries will apply to any animals but those on which they were empirically based. To Andrew Murray is awarded the commendation that as early as 1866 he "inquires into causes for the existing condition of things, and finds them in the geological development of the earth, in the changing distribution of land and water, and at the same time lays stress on the importance of barriers and the limits of range". Thus was he an important forerunner of Wallace, who first effectively established the fundamental principles that the distribution of life is dependent on the geological history of the earth's surface, on

[1] *The Labium and Sub-mentum in certain Mandibulate Insects*, by C. O. Waterhouse.

limits of range, on means of dispersal, and that the two latter influences are different for different animals.

Dr. Ortmann considers that the pecularities in the conditions of existence which affect animal life may conveniently be grouped under three headings, as those which have to do with light, medium and substratum. Without light there is no vegetation. Without vegetation there is no food which animals can assimilate. According to the medium in which they live they must be fitted for air-breathing or water-breathing. The substratum may be dry land or ocean floor, but those animals which are dependent upon either must have the locomotive apparatus by which they obtain their food adapted accordingly. From these considerations Dr. Ortmann divides the globe into five principal life-areas. The medium distinguishes the land-area, of which the occupants are air-breathers, from all the rest. The abyssal area is set apart from all by the absence of light. The pelagic area stands alone in having occupants independent of any solid resting-place. The fluvial or fresh water area carries its characteristic in its name, and there remains the littoral area, not so sharply marked off as the others, but perhaps the most important of all, if from its teeming bosom the thronging forms of life have felt and found their way into all the other areas, spreading over the high seas, colonising the profoundest abysses, threading their course up estuaries and rivers, climbing the terraces of the land and taking wing beyond the clouds.

By paying regard to climatic and topographical relations, Dr. Ortmann finds himself able to subdivide the littoral and the pelagic areas into regions and subregions. In each there is an Arctic, an Antarctic, and an Indo-pacific region. In the pelagic area there is also an Atlantic region, while in the littoral there are three additional regions, a West-American, an East-American, and a West-African. In the last a Mediterranean subregion is distinguished from a Guinea subregion, and there are similar and further subdivisions suggested in some of the other areas. Only the abyssal area is spoken of as "without differentiation into regions and subregions". As distinguished from the Continental, Freshwater, and Littoral areas, the author maintains that "in the Abyssal and Pelagic areas the continuity is complete, in no part of the earth are special portions of these two topographically separated from others, but everywhere they stand in direct communication". This mode of viewing the abyssal area seems to be of very doubtful validity. There are submarine mountains, submarine lakes, warm currents and cold currents functioning as submarine rivers, which must operate as climatic and topographical barriers as forcibly in the unlighted marine abysses as they do in the realms of daylight. Considering, too, the intimate dependence of animal life upon the available food, it would be strange indeed if no regions and subregions were marked by the varying character of the ocean floor, with its diatom ooze and radiolarian ooze and globigerina ooze, and other distinctive coatings. Were the deep sea in fact an uninterrupted uniform expanse, it might be expected, and at one time was expected, to have a fauna common to the whole of it. But of this there is at least no striking evidence, and Dr. John Murray of *The Challenger* adduces some evidence which is rather striking in the contrary direction. Thus at a station in mid-equatorial Atlantic, in 1850 fathoms, 38 species were obtained. At a station in mid-equatorial Pacific, in 2425 fathoms, 29 species were obtained. Both were on globigerina ooze. Only one species was common to the two localities, and that one the little *Discina Atlantica*, belonging to a genus which ranges from the Cambrian to the present time.

In the vast area of the subject there are many regions and subregions of discussion into which this short notice cannot follow Dr. Ortmann. All that he has to say, whether it commands assent or otherwise, will be found worthy of attention. He brings very clearly into view the merits and occasionally the demerits of his predecessors. He shows how much we have still to learn, what points of vantage have been attained, in what direction the line of advance should be followed with most hope of success. The zoologist can scarcely peruse this memoir without finding that his own scientific studies from one side or another are closely connected with the complex problem of the distribution of animals.

APPENDIX II.

CHEMICAL LITERATURE FOR MARCH, 1896.

Vol. i. No. 4. *American Journal of Science.* (April, 1896.)

Wolff, J. E., Occurrence of Theralite in Costa Rica, Central America (pp. 271-273). *Merrill, G. P.*, Occurrence of Free Gold in Granite (pp. 309-312).

Vol. xviii. No. 4. *Journal of the American Chemical Society.* (April, 1896.)

Morehead, J. T., and *De Chalmot, G.*, The Manufacture of Calcium Carbide (pp. 311-331). *Gomberg, M.* On the Action of Wagner's Reagent upon Caffeine and a New Method for the Estimation of Caffeine (pp. 331-342). *Long, J. H.*, On the Formation of Antimony Cinnabar (pp. 342-347). *Gomberg, M.*, Perhalides of Caffeine (pp. 347-378). *Wiley, H. W.*, Determination of the Heat of Bromination in Oils (pp. 378-385). *Mixer, C. T.*, and *Du Bois, H. W.*, Särnströms Method of Determining Manganese in Iron Ores (pp. 385-389). *Veitch, F. P.*, On the Various Modifications of the Pemberton Volumetric Method for Determining Phosphoric Acid in Commercial Fertilisers (pp. 389-397). *Bigelow, W. D.*, Index to the Literature on the Detection and Estimation of Fusel Oil in Spirits (pp. 397-402). *Wait, C. E.*, The Occurrence of Titanium (pp. 402-404). *Cone, E. F.*, The Estimation of Pyrrholite in Pyrites Ores (pp. 404-406). *Auchy, G.*, Drown's Method of Determining Sulphur in Pig Iron (pp. 406-412).

Vol. xviii. No. 3. *American Chemical Journal.* (March, 1896.)

Orndorff, W. R., and *Terrasse, G. L.*, The Molecular Weight of Sulphur (pp. 173-207). *Mabery, C. F.*, On the Determination of Sulphur in Illuminating Gas and in Coal (pp. 207-215). *Mabery, C. F.*, and *Dunn, O. C.*, Chemistry of the Berea Grit Petroleum (pp. 215-236). *Morse, H. N.*, and *Chambers, A. D.*, A Method for the Standardisation of Potassium Permanganate and Sulphuric Acid (pp. 236-238). *Jackson, C. L.*, and *Gallivan, F. B.*, Some Derivatives of Unsymmetrical Tribrombenzol (pp. 238-252).

Vol. xxi. No. 241. *The Analyst.* (April, 1896.)

Allen, A. H., Note on the Titration of Quinine (pp. 85-87). *Allen, A. H.*, Note on the Preparation of Pure Hydrochloric Acid (pp. 87-88). *Richmond, H. D.*, The Composition of Milk and Milk Products (pp. 88-92). *Richmond, H. D.*, and *Boseley, L. K.*, Further Notes on the Detection of Formalin (pp. 92-94). *Hehner, O.*, The Detection of Formalin (pp. 94-99). *Shepherd, H. H. B.*, Official Methods for the Analysis of Fertilisers, issued by the German Manure Manufacturers' Association (pp. 99-102).

Vol. lxix. No. 401. *Journal of the Chemical Society.* (April, 1896.)

Humphreys, W. J., Solution and Diffusion of certain Metals in Mercury (pp. 243-253). *Bone W. A.*, and *Perkin, W. H., Jun.*, The Symmetrical Dimethylsuccinic Acids (pp. 253-268). *Bone, W. A.*, and *Perkin, W. H., Jun.*, Note on the αα-Dimethylglutaric Acids (pp. 268-270). *Bentley, W. H.*, *Perkin, W. H., Jun.*, and *Thorpe, J. F.*, *Cis-* and *trans-*Methylisopropylsuccinic Acid (pp. 270-287). *Wood, T. B.*, Available Potash and Phosphoric Acids in Soils (pp. 287-292).

Vol. xv. No. 3. *Journal of the Society of Chemical Industry.* (31st March, 1896.)

Schack-Sommer, G., Sorghum Sugar Manufacture in Spain (p. 155). *Saniter, E. H.*, The Analysis of Chrome Ore and Ferro-Chromium (pp. 155-158). *Grossmann, J.*, Recent Developments in the Manufacture of Chlorates (pp. 158-161). *Macadam, S.*, On Destructors for Consuming Town Refuse—their Requirements, Defects, and Modes of Improvement (pp. 162-169). *Clowes, F.*, The Estimation of Oxygen by Alkaline Solution of Pyrogallol (p. 170). *Caven, R. M.*, Some Properties of Ferric Phosphate (Discussion) (pp. 170-171). *Richardson, F. W.*, and *Aykroyd H. E.*, Sulphides, Sulphites, Thiosul-

phates, and Sulphates—their Estimation in Presence of Each Other (pp. 171-173). *Steaurt, D. R.*, The Standard of Minimum Flash-Point for Mineral Oil (pp. 173-179). *Thompson, C. W.*, Method of Analysis of Alloys of Lead, Tin, Antimony and Copper (pp. 179-182). *Warwick, A. W.*, Laboratory Testing in connection with Gold Extraction (pp. 182-184).

Vol. 41. No. 251. *Philosophical Magazine and Journal of Science.* (April, 1896.)

Arrhenius S., On the Influence of Carbonic Acid in the Air upon the Temperature of the Ground (pp. 237-276). *Witkowski, A. W.*, Thermodynamic Properties of Air (pp. 288-315). *Ramsay, W.*, and *Eumorfopoulos, N.*, On the Determination of High Temperatures with the Meldometer (360-367). *Wood, R. W.*, A Duplex Mercurial Air-pump (pp. 378-381).

Vol. lix. No. 355. *Proceedings of the Royal Society.* (30th March, 1896.)

Lord Raleigh, On some Physical Properties of Argon and Helium (pp. 198-208). *Tilden, W. A.*, An Attempt to Determine the Condition in which Helium and the Associated Gases exist in Minerals (218-224). *Schunck, E.*, and *Marchlewski, L.*, Contributions to the Chemistry of Chlorophyll VII., Phylloporphyrin and Hæmatoporphyrin—a Comparison (pp. 233-236). *Dunstan, W. R.*, and *Boole, L. E.*, An Enquiry into the Nature of the Vesicating Constituent of Croton Oil (pp. 237-249).

Tome vii. *Annals de Chemie et de Physique.* (April, 1896.)

Malbot, H. et *A.*, Recherches sur les phosphats d'Algérie. Cas d'un roche présentant la composition d'un superphosphate (pp. 433-520). *Moissan, H.*, et *Gautier H.*, Détermination de la chaleur spécifique du bore (pp. 495-573).

Tomes xv.-xvi. No. 6. *Bulletin de la Société Chimique de Paris.* (20th March, 1896.)

Tassilly, Oxyiodures de Zinc (pp. 345-347). *Urbain, G.*, Contribution à l'étude du thorium (pp. 347-349). *Tanret, C.*, Sur les modifications moléculaires et la multirotation des sucres (pp. 349-361). *Secretant*, Ethers phosphoriques des phénols polyatomiques (pp. 361-364). *Reychler, A.*, Sur le chlorure de géranyle (pp. 364-366). *Reychler, A.*, Études sur les terpènes (pp. 366-376).

Tome xv.-xvi. No. 7. (5th April, 1896.)

Carnot, A., Analyse, par les procédés volumétriques, d'un mélange de chlorures, d'hypochlorites et de chlorates (pp. 393-397). *Carnot, A.*, Analyse d'un mélange de chlorures, de chlorates et de perchlorates (pp. 397-399). *Varet, R.*, Loi des doubles décompositions entre le cyanure de mercure et les sels des métaux alcalins et alcalind-terreux (pp. 399-400). *Fournier, H.*, Sur les carbures diéthyléniques (pp. 400-404). *Biétrix, A.*, Action de la nitroso-diméthylaniline sur quelques dérivés bromés de l'acide gallique (pp. 404-409). *Genvresse, P.*, Contribution à l'étude des disulfures aromatiques (pp. 409-426). *Béchamp, A.*, Sur les altérations spontanées du lait et sur celles que la cuisson lui fait subir (pp. 426-455). *Urbain, G.*, Sur la réaction de Schiff (pp. 455-456). *Violette, C.*, Azurage des farines par le bleu d'aniline. Comment on peut le reconnaître (p. 456).

Tome cxxii. No. 10. *Comptes Rendus hebdomadaires de l'Académie des Sciences.* (9th March, 1896.)

Gautier, A., et *Hélier, H.*, Sur quelques conditions qui règlent les combinaisons gazeuses. Union de l'oxygène à l'hydrogène aux basses températures (pp. 566-573). *Moissan, H.*, et *Etard*, Sur les carbures d'yttrium et de thorium (pp. 573-578). *Thomas, V.*, Action du peroxyde d'azote et de l'air sur le chlorure de bismuth (pp. 611-613). *Coquillion, J.*, Sur les modifications apportées au grisoumètre et sur la limite d'approximation qu'il peut donner (pp. 613-615). *Schloesing, T.*, et *Richard, J.*, Recherches de l'argon dans les gaz de la vessie natatoire des Poissons et des Physalies (pp. 615-617). *Rivals, P.*, Étude thermochimique des amides et des sels ammoniacaux de quelques acides chlorés (pp. 617-619). *Scheurer-Kestner*, Sur la détermination de l'acidité des produits pyroligneux (pp. 619-621). *Ferrand*, Sur une nouvelle série de sulfophosphures: les thiophosphates (pp. 621-622). *Combes, C.*, Sur quelques dérivés du triphénylsilicoprotane (pp. 622-624). *Bouchardat, G.*, et *Tardy*, Sur l'essence d'anis de Russie (pp. 624-626).

Tome cxxii. No. 11. (16th March, 1896.)

Moissan et *Lengfeld*, Sur un nouveau carbure de zirconium (pp. 651-654). *Ponsot, A.*, Recherches cryoscopiques (pp. 668-670). *Charpy, G.*, Sur la structure et la constitution des alliages de cuivre et de zinc (pp. 670-672). *Appert, L.*, Sur le rôle de l'alumine dans la composition des verres (pp. 672-673). *Barbier, P.*, et *Bouveault, L.*, Constitution du rhodinol (pp. 673-675).

Tome cxxii. No. 12. (23rd March, 1896.)

Becquerel, H., Sur les radiations invisibles émises par les sels d'uranium (pp. 689-694). *Schutzenberger* et *Boudouard*, Recherches sur les terres contenues dans les sables monazités (pp. 697-699). *Schloesing, T.*, Sur les quantités d'acide nitrique contenues dans les eaux de la Seine et de ses principaux affluents (pp. 699-703). *Demarçay, E.*, Sur un nouvel élément contenu dans les terres rares voisines du samarium (pp. 728-730). *Brizard, L.*, Action des réducteurs sur les composés du ruthénium nitrosé (pp. 730-733). *Férée, J.*, Sur les amalgames de molybdène et quelques propriétés du molybdène métallique (pp. 733). *Barillot, E.*, Sur les produits de la distillation du bois (expériences industrielles) (pp. 733-736). *De Coninck, O.*, Sur l'isomérie dans la série aromatique (pp. 736-737). *Barbier, P.*, et *Bouveault, L.*, Sur le rhodinal et sa transformation en menthone (pp. 737-739).

Tome cxxii. No. 13. (30th March, 1896.)

Becquerel, H., Sur les propriétés différentes des radiations invisibles émises par les sels d'uranium, et du rayonnement de la paroi anticathodiqué d'un tube de Crookes (pp. 762-767). *Moureu, C.*, Safrol et isosafrol. Synthèse de l'isosafrol (pp. 792-795). *Barbier, P.*, et *Bouveault, L.*, Sur le citronnellal et son isomérie avec le rhodinal (pp. 795-796).

Tome cxxii. No. 14. (7th April, 1896.)

Tassilly, Etude thermique de quelques oxybromures (pp. 812-814). *Besson, A.*, Action des acides bromhydrique et iodhydrique sur le chlorure de phosphoryle (pp. 814-817).

16e Année. Tome iii. No. 6. *Journal de Pharmacie et de Chimie.* (15th March, 1896.)

Prunier, L., Note sur la préparation du sulfoantiomoniate de sodium (sel de Schlippe) (pp. 289-290). *Maréchal. Le*, Note sur la conservation des outils en acier (pp. (290-292). *Balland*, Sur la composition des riz importés en France (pp. 292-295).

16e Année. Tome iii. No. 7. (1st April, 1896.)

Prunier, L., Essai des iodures officinaux (pp. 337-341). *Lagüe, P.*, Sur l'essai du kermès (pp. 341-343). *Lafay, L.*, Contribution à l'étude des liquides ascitiques ; ascite d'origine tuberculeuse (pp. 343-346). *Gorges*, Sur une cause d'erreur dans la recherche et le dosage de l'acide borique (pp. 346-347).

Tome xxviii. No. 1. *Journal de la Société Physico-Chimique Russe.*

Bogorodsky, A., Sur les cryohydrates (pp. 1-10). *Chaternikoff, M.*, et *Setchenoff, J.*, Appareil pour analyse des gaz (pp. 10-17). *Tichvinsky, M.*, Sur les relations des safranines et des indulines (pp. 17-24). *Reformatsky, S.*, Action du zinc et de l'ether bromoisobutyrique sur l'aldehyde isobutyrique (pp. 24-40). *Barilowitsch, A.*, Sur l'acide diisopropyloxalique (pp. 40-47). *Ostropiatoff, P.*, Action de la potasse sur l'acétonechloroforme (pp. 47-56). *Wagner, G.*, Sur la structure des terpènes et composés congenères (pp. 56-109). *Markownikoff, W.*, La source de Narsane ; *Menschutkin, N.*, Sur les sels des amides ; *Saposchnicoff, A.*, Sur les propriétés des solutions aqueuses de l'acétone ; *Melikoff, P.*, Sur le metéorite de Zmen ; *Wagner, G.*, Sur le dosage de l'agrostemme dans la farine ; *Speransky, A.*, Sur le rhodanure de chrome ; *Melikoff, P.*, Sur les conditions de la formation de la soude naturelle (pp. 109-116).

Band ccxc. Heft 3. *Justus Liebig's Annalen der Chemie.* (7th March, 1896.)

Kehrmann, F., Ueber die Beziehungen der Induline zu Safraninen (pp. 247-306). *Schunck, E.*, und *Marchlewski, L.*, Zur Chemie des Chlorophylls. IV. (pp. 306-314). *Hesse, O.*,

Zur Geschichte des Proteacins (pp. 314-317). *Hesse, O.*, Ueber den Zuckerbusch (pp. 317-321). *Zincke, T.*, Ueber die Einwirkung von Chlor auf Oxychinoline (p. 321). *Zincke, T.*, und *Winzheimer, E.*, Ueber Chloroxy-α-chinolin-chinon und dessen Umwandlungsproducte Hydrinden-, Inden- und Acetophenonderivate der Pyridenreihe, (pp. 321-359). *Zincke, T.*, und *Wiederhold, K.*, Ueber Dichlor- β-chinolinchinon und dessen Umwandlungsproducte (pp. 359-382).

Band ccxxxiv. Heft 3. *Archiv der Pharmacie.* (24th March, 1896.)

Piutti, A., Einwirkung der Bernsteinsäure auf p- Amidophenol und dessen Aether (Pyranlin) (pp. 161-170). *Böttinger, C.*, Ueber Abkömmlinge der Naphthylamine (pp. 170-195). *Hesse, O.*, Ueber die Prüfung des Chininsulfats (pp. 195-204). *Peinemann, K.*, Beiträge zur pharmacognostischen und chemischen Kenntnis der Cubeben und der als Verfälschung derselten beobachteten Piperaceenfrüchte (pp. 204-240).

Jahrgang xxix. No. 5. *Berichte der Deutschen Chemischen Gesellschaft.* (23rd March, 1896.)

Bamberger, E., Zur Kenntniss normaler Diazometallsalze (pp. 564-577). *Veley, V. H.*, Die Reactionsunfähigkeit alkalischer Erden gegen Chlorwasserstoffgas (pp. 577-581). *Fischer, E.*, und *Bromberg, O.*, Ueber eine neue Pentonsäure und Pentose (pp. 581-586). *Richter, M. M.*, Ein Beitrag zur Nomenclatur (pp. 586-608). *Bamberger, E.*, Notiz, betreffend die Ionenzahl der diazosulfonsauren Salze (pp. 608-610). *Scholtz, M.*, Zur Kenntniss der Semicarbazone (pp. 610-613). *Scholtz, M.*, Ueber einige Derivate des Zimmtaldehyds (pp. 613-615). *Staedel, W.*, Synthese des Diphenylketons und seiner Derivate (pp. 615-616). *Zelinsky, N.*, Zur Kenntniss der stereoisomeren Dimethyltricarballylsäuren (pp. 616-618). *Darmstaedter, L.*, und *Liffschütz, J.*, Beiträge zur Kenntniss der Zusammensetzung des Wollfetts (pp. 618-622). *Rupe, H.*, und *Heberlein, G.*, Ueber unsymmetrische α-Phenylhydrazinderivate (pp. 622-623). *Pinnow, J.*, und *Sämann, C.*, Ueber Derivate des o- Amido-benzonitrils (pp. 623-633). *Reissert, A.*, Ueber die Einwirkung von o- und p- Nitrobenzylchlorid auf Natriummalonsäureester und einige analoge Verbindungen (pp. 633-639). *Reissert, A.*, Umwandlungen des o- Nitrobenzylmalonsäureesters I. Alkalische Verseifung, Synthese neuer Indolabkömmlinge (pp. 639-665). *Reissert, A.*, Umwandlungen des o- Nitrobenzylmalonsäureesters II. Reduction, Bildung von Chinolinderivaten (pp. 665-667). *Traube, W.*, Ueber einen neuen Weg zur Gewinnung aliphatischer Diazoverbindungen (pp. 667-670). *Traube, W.*, und *Longinescu, G. G.*, Ueber Hydrazinosäuren (pp. 670-676). *Hell, C.*, und *Portmann, B.*, Ueber die Einwirkung des Natriumäthylats auf Aethylisoeugenoldibromid (pp. 676-682). *Hell, C.*, und *Hollenberg, A.*, Ueber die Einwirkung von Natriumäthylat auf Anetholdibromid und Monobromanetholdibromid (pp. 682-691). *Tiemann, F.*, und *Schmidt, R.*, Ueber Homolinalool (pp. 691-695). *Reychler, A.*, Ueber die Einwirkung von Trichloressigsäure auf Terpene (pp. 695-697). *Reychler, A.*, Ueben Isobornylchlorid und Camphenchlorhydrat (pp. 697-699). *Hantzsch, A.*, und *Schultze, W.*, Ueber Isomerie beim Phenylnitromethan (pp. 699-703). *Knueppel, C. A.*, Ueber eine Verbesserung des Skraupschen Verfahrens zur Darstellung von Chinolin und Chinolinderivaten (pp. 703-710), *Michaelis, A.*, und *Luxembourg, K.*, Ueber anorganische Derivate der secundären aliphatischen Amine (pp. 710-716). *Michaelis, A.*, und *Silberstein, E.*, Ueber Oxyphosphazoverbindungen (pp. 716-729). *Zelinsky, N.*, und *Generosow, A.*, Untersuchungen in der Hexamethylenreihe IV. Abhandlung Synthese von Heptanaphten (pp. 729-734). *Klinger, H.*, und *Lonnes, C.*, Ueber die Einwirkung von Schwefelsäure auf Benzilsäure (pp. 734-742). *Wislicenus, W.*, Ueber das Verhalten alkalischer Lösungen des Formylphenylessigesters gegen Säuren (pp. 742-743). *Gerilowski, D.*, und *Hantzsch, A.*, Weiteres ueber die stereoisomeren Salze aus Diazosulfanilsäure (pp. 743-756).

Jahrgang 29. No. 6. (13th April, 1896.)

Curtius, T., Ueber Hydrazin, Stickstoffwasserstoff und die Diazoverbindungen der Fettreihe (pp. 759-784). *Hinsberg, O.*, und *Pollak, J.*, Ueber einige Abkömmlinge des Dichlorchinoxalins (pp. 784-788.) *Coste, J. H.*, und *Parry, E. J.*, Ueber die Nitirung von Brombenzol (pp. 788-793). *Fischer, E.*, Ueber das Azophenyläthyl und das Acetaldehydphenylhydrazon (pp. 793-798). *Paal, C.*, Ueber $\alpha\alpha^1$-Diphenylpyridin-und-piperidin (pp. 798-801). *Konek von Norwall, F.*, Ueber Hydroderivate von Chinaalkaloïden (pp. 801-806). *Behrend, O.*, Constitutionsbeziehungen zwischen Ricinölsäure und Oelsäurederivaten (pp. 806-810). *Spieckermann, A.*, Ueber die Constitution der Behenoxyl- und

Stearoxylsäure (pp. 810-813). *Goldstein, J.*, Ueber das Verhalten von aromatischen Basen gegen Benzal- und Furfuralmalonsäureester (pp. 813-819). *Zelinsky, N.*, und *Isajew, W.*, Ueber Stereoisomere Dimethyldioxyadipinsäuren (pp. 819-821). *Küster, W.*, Beiträge zur Kenntniss des Hämatins (pp. 821-824). *Graebe, C.*, und *Ullmann, F.*, Ueber eine neue Darstellungsweise des *o*-Oxybenzophenons (pp. 824-826). *Graebe, C.*, Ueber Synthese des Chrysoketons (Naphtofluorenon) und Constitution des Chrysens (pp. 826-829). *Rupe, H.*, Ueber unsymmetrische α-Phenylhydrazinverbindungen (pp. 829-830). *Meyer, V.*, Neue Untersuchungen ueber die Gesetze der Oxim-, Hydrazon- und Esterbildung (pp. 830-839). *Loon, J. van*, und *Meyer, V.*, Das Fluorund die Esterregel (pp. 839-846). *Meyer, V.*, und *Sohn, C.*, Ueber eine eigenthümliche Bildungsweise der trimethylirten Mandelsäure (p. 846). *Meyer. V.*, Ueber die Darstellung einfach und zweifach acetylirter aromatischer Kohlenwasserstoffe (pp. 846-848). *Meyer, V.*, Ueber die Salzbildung des Trinitrobenzols (pp. 848-850). *Meyer, V.*, Ueber die Schmelzbarkeit des Platins im Kohlen-Gebläseofen (pp. 850-852). *Freund, M.*, und *Niederhofheim, R.*, Beitrag zur Kenntniss des Pseudaconitins (pp. 852-859). *Freund, M.*, und *Heilbrun, R., L.*, Ueber die Einwirkung von Salzsäure auf Hydrazo-di-carbonthioallylamid (pp. 859-863). *Bamberger, E.*, und *Knecht, M.*, Ueber die Reduction der Nitro- zur Hydroxylamingruppe (pp. 863-865). *Dierbach, R.*, Ein neuer Bunsenbrenner (pp. 865-866). *Stoermer, R.*, und *Pogge, W.*, Ueber disubstituirte Amidoacetone (pp. 866-875). *Gnehm, R.*, und *Bänziger, E.*, Ueber die bei der Chlorirung von Benzaldehyd auffretenden Producte und einige Derivate derselben (pp. 875-878). *Friedländer, P.*, und *Rüdt, H.*, Die Darstellung von Flavonderivaten (pp. 878-881). *Wagner, G.*, und *Ertschikowsky, G.*, Zur Oxydation des Pinens (pp. 881-886). *Wagner, G.*, und *Ginsberg, A.*, Zur Constitution des Pinens (pp. 886-890). *Tiemann, F.*, Bemerkungen zur Pinenfrage (pp. 890-892). *Ritthausen, H.*, Wassergehalt und reaction des Alloxantins (pp. 892-894). *Ritthausen, H.*, Ueber Alloxantin als Spaltungs product des Convicins aus Saubohnen (Vicia Faber minor) und Wicken (Vicia sativa) (pp. 894-896). *Ritthausen, H.*, Ueber Galactit aus den Samen der gelben Lupine (pp. 896-900). *Reychler, A.*, Ueber Camphenbromid (pp. 900-901). *Tiemann, F.*, und *Krüger, P.*, Ueber ein Verfahren zur Reinigung von Alkoholen (pp. 901-903). *Tiemann, F.*, und *Schmidt, R.*, Ueber die Verbindungen der Citronnellalreihe (pp. 903-926). *Tiemann, F.*, und *Krüger, P.*, Ueber zwei sauerstoffhaltige Basen aus Citronellaldoxim (pp. 926-928). *Mahla, F.*, und *Tiemann, F.*, Ueber Terpenylsäure (pp. 928-936). *Willstälter, R.*, Ueber ψ- Tropin (pp. 936-947). *Hantzsch, A.*, und *Hirsch, B.*, Ueber intramolekulare Umlagerungen von Diazoniumrhodaniden (pp. 947-953). *Lucas, A.*, Vicinales Trimethylbenzol als Begleiter des synthetischen Mesitylens (pp. 953-958). *Hantzsch, A.*, Zur Synthese und Constitution des Benzols (pp. 958-961). *Thiele, J.*, und *Meyer, C.*, Reduction des Methyl-und Aethyl-nitramins (pp. 961-964). *Einhorn, A.*, und *Bull, B. S.*, Ueber das Ortho- Hexamethylendiamin (pp. 964-966). *Bischoff, C. A.*, Studien ueber Verkettungen III. Umsetzung von Chloressigester mit Natrium- malon- und -acet- essigestern (pp. 966-972). *Bischoff, C. A.*, Studien ueber Verkettungen IV. Umsetzungen der Natrium -(Alkyl). Malonsäure-ester mit α- Bromfettsäure-estern (pp. 972-979). *Bischoff, C. A.*, Studien ueber Verkettungen V. Umsetzungen der Natrium- (Alkyl). Acetessigester mit α- Brom- fettsäure-estern (pp. 979-982). *Bischoff, C. A.*, Studien ueber Verkettungen VI. Theoretische Ergebnisse der Versuche ueber die Bildung substituirter Aethenyltricarbonsäure- und Acetylsuccinsäureester (pp. 982-989). *Henrich, F.*, Ueber zwei Modificationen des Mononitrosoorcins (pp. 989-994). *Petrenko-Kritschenko, P.*, und *Stanischewsky, S.*, Ueber die Condensation der Aldehyde mit Acetondicarbonsäure-estern (pp. 994-997). *Reverdin, F.*, Ueber einige Jodderivate des Anisols und ueber einen Wanderungsfall des Jod-Atoms (pp. 997-1005). *Clasien, L.*, Ueber die Einwirkung des Orthoameisenäthers auf Ketonsäureäther, Ketone und Aldehyde (pp. 1005-1008). *Weinland, R.F.*, und *Rumpf, O.*, Ueber Sulfoxyarsenate (pp. 1008-1013). *Herzig, J.*, Ueber das Luteolin (pp. 1013-1015). *Romburgh, P. van*, Ueber die Nitrirung vom Dimethyl-p-toluidin (pp. 1015-1016). *Ruhemann, S.*, Einige Beobachtungen in der Pyrazolonreihre (pp. 1016-1018).

Band liii. Nos. 4-5. *Journal für praktische Chemie.* (29th February, 1896.)

Ipatiew, W., Ueber die Einwirkung von Bromwasserstoff auf Kohlenwasserstoffe der Reihe $C_n H_{2n-2}$ (pp. 145-169. *Blomstrand, C. W.*, Ueber die Constitution der aromatischen Diazokörper und ihrer Isomeren (pp. 169-197). *Claus, A.*, und *Hartmann, G.*, Orthoana, Ortho- para, und Meta- ana- dionitrochinolin (pp. 197-210). *Kratz, K.*, Ueber

Derivate des m- nitro- o- Amidobenzamids und m- nitro- o- Amidobenzhydrazids (pp. 210-225). *Bertram, J.*, und *Gildemeister, E.*, Ueber Geraniol und Rhodinol (pp. 225-237). *Hesse, A.*, Ueber die vermeintliche Identität von Reuniol, Rhodinol und Geraniol (pp. 237-241). *Vaubel. W.*, Der Benzolkern VI. (pp. 241-246). *Herfeldt, G.*, Zur Kentniss der Kyanalkine, ins besondire des Kyanbenzylins (pp. 246-250). *Brüggemann, F.*, Ueber Derivate des Veratrols (pp. 250-255). *Liebermann, C.*, Herrn. Michael zur Erwiderung (pp. 255-256).

Band xi. Heft 6. *Zeitschrift für Anorganische Chemie.* (2nd April, 1896.)

Vanderberghe, A., Ueber die Darstellung von reinem Molybdän (pp. 385-397). *Vanderberghe, A.*, Einwirkung einiger Gase auf erhitzes Molybdän (pp. 397-404). *Lovén, J. M.*, Chemisches Gleichgewicht in ammoniakalischen Magnesiumsalzlösungen (pp. 404-416). *Jörgensen, S. M.*, Zur Konstitution der Kobalt, Chrom- und Rhodium- basen (pp. 416-454). *Barendrecht, H. P.*, Dimorphie des Eises (pp. 454-456).

Band xix. Heft 3. *Zeitschrift für Physikalische Chemie.* (31st March, 1896.)

Biltz, H., Ueber die Bestimmung der Molekulargrösse einiger anorganischer Substanzen (pp. 385-431). *Zecchini, F.*, Beitrag zur Kenntis der organischen Verbindungen des vierwertigen Sauerstoffes (pp. 431-436). *Gennari, G.*, Ueber die Geschwindigkeit der Verseifung in organischen Lösungsmilteln (pp. 436-441). *Salzer, T.*, Eine Krystallwasser- Theorie (pp. 441-456). *Lovén, J. M.*, Affinitäts-grössen einiger organischen Säuren (pp. 456-465). *Donnan, F. G.*, Versuche ueber die Beziehung zwischen der elektrolytischen Dissociation und der Lichtabsorption in Lösungen (pp. 465-489). *Norák, V.*, und *Sulc, O.*, Ueber die Absorption von Röntgens Strahlen durch Chemische Verbindungen (pp. 489-513).

Anno xxvi. Vol. I. Fascicolo I. *Gazzetta Chimica Italiana.* (15th February, 1896.)

Giustiniani, E., Sopra alcuni costituenti dell'ortica (pp 1-7). *Angeli, A.*, e *Rimine, E.*, Sopra il nitrosito dell'isosafrolo (pp. 7-13). *Cannizzaro, S.*, e *Andreocci, A.*, Sulla costituzione del dimetilnaftol proveniente dalla scomposizione degli acidi santonosi (pp. 13-35). *Namias, R.*, Considerazioni fotochimiche e termofotochimiche (pp. 35-52). *Baltiano, L.*, Brevi osservazioni sulla nota dei signori Fr. Mahla e Ferd. Tiemann: Zum Abbau der Camphersäure (pp. 52-61). *Garelli, F.*, Sopra alcune soluzioni solide formate da sostanze non isomorfe (pp. 61-88).

APPENDIX I.

NOTICES OF BOOKS.

Lehrbuch der Entwicklungsgeschichte des Menschen und der Wirbelthiere. Von Prof. Dr. O. Hertwig (Fünfte theilweise umgearbeitete Auflage). Jena: Gustav Fischer, 1896.

The fact that this admirable work has entered upon a fifth edition in its ninth year is sufficient testimony to its success. The plan of the book remains unaltered, but the whole has been brought up to date. The sections dealing with the Structure of the Chorion, the Development of the Intermediate Germ Layer in Reptiles and Mammals, and the Genesis of the Cellular Elements of the Blood, are conspicuous among those which have received attention, and the recent work of Keibel, Will, von Kupffer, Kundrat and Engelmann, Leopold, Minot, and others, has been largely laid under obligation. This fifth edition is, however, most noteworthy for the fuller treatment of cytological topics, there having been added sections dealing with the *rôle* of the Centrosome in Fertilisation and the Reduction Division, and a short chapter of eight pages upon the "Mosaic Theory" of Roux and recent experimental work which bears upon it. Twenty-two illustrations have been added; but, seeing how great has been the success of this work, we had wished for the replacement in late editions of the hundred and one well-worn illustrations which nauseate us by their reappearance in text-book after text-book. Rathke's time-honoured diagrams of the development of the aortic arches are once more reproduced in full, but the work of Boas, Hochstetter, and Zimmermann, upon the pre-pulmonary arch, which has undermined them, is mentioned only in small type. This is but one of several instances in which recent work of a far-reaching order is insufficiently transcribed, and in some cases the incorporation in the "Literature" of titles of important papers has been considered sufficient recognition of their authors' work. We regret the introduction of Fol's *Quadrille des Centres* (notwithstanding the mention of the adverse results obtained by Boveri, Wilson, and Mathews) and of the would-be corroborative statements of Guignard. This and certain other very debatable topics might well have been left aside, in preference say for a fitting recognition of substantial observations such as Mitsukuri's upon the Mesoderm and Cœlom of the Chelonia and Haacke's and Giacomini's upon the allantoir placenta of the Lacertilia. The scanty recognition of the Invertebrata has been regarded as an objection to this work, it having been looked upon as ignoring the great middle series which lie between man and the higher animals and the lower organisms. This opinion appears to us to have arisen from a misconception of the author's aims, and it is certainly less justified of the present edition than any of its predecessors. The book deals professedly with the broader aspects of the organology of the vertebrata and with cytological questions which largely border on the physiological and the study of first principles; and in these associations the lower animals appear to us to have received ample consideration at the author's hands. His work is emphatically one for medical students, and as meeting their demands it appears to us unequalled. It is now well-established, and if the author would give us an edition in which illustrations, new and numerous, should be of the same excellence as the text, he would confer a boon on medical education.

Evolution in Art: as Illustrated by Life-Histories of Designs. By Alfred C. Haddon, Professor of Zoology, Royal College of Science, Dublin. With 8 plates and 130 figures in the text. The Contemporary Science Series. London: Walter Scott, Limited, 1895.

There is no training for a young biologist equal to a sojourn amongst the strange plants and animals of a tropical region. Darwin in the *Challenger*, Huxley in the *Rattlesnake*, received such a training and acquired the methods and material that made their reputations. It is an education that gives the mind of the scientific worker a broad bent, and makes many subjects have an interest for him. Before Professor Haddon made his journey to British New Guinea and the adjacent coasts he was known as a zoologist, a geologist, and an embryologist, but since then he has become better known as an anthropologist. It was his hap to land in a

region inhabited by mixed races of uncertain and puzzling origin, with strange customs and habits, and, above all, with a crudely rich and elaborate style of ornamentation. It was amongst the ornamental designs of those races that Professor Haddon commenced in earnest a study of the life-histories of the designs found in native art, and the results of that study he gave us in the form of a valuable memoir in the Cunningham Series of the Royal Irish Academy. In this book the author has gone much further afield, and has written what is practically an introduction to the study of decorative designs all the world over. His British New Guinea researches form the nucleus of the book and give him the clue to many of his deductions. The essence of his method may be said to lie in studying each design separately, tracing its origin to some prototype, observing the meaning attached to it, working out its life-history, noting the transmutations it undergoes, and collecting the intermediate forms of the devices until he gets a series that connects the final meaningless conventionality with the real and living form from which it has evolved. The material from which designs are drawn gives him a basis for their classification. All designs, he finds, may be classified either under *zoomorphs*, those derived from animal forms, or *anthropomorphs*, those obtained from human forms, or *phyllomorphs*, those originating from plant forms, or *physicomorphs*, devices drawn from the material universe, or *skeuomorphs*, decorations obtained from copying forms of handiwork already in existence. From these sources, or a combination of them, often aided by a fantastic imagination, saving perhaps some plain and geometrical designs, savage and civilised people alike have drawn all their designs.

Nearly all the life-histories of designs given by the author are convincing and of extreme interest. The crocodile device, the frigate-bird, the face, the scroll, the lotus flower, the fylfot, and many other designs, are well worked out and amply illustrated. It is often extremely difficult, sometimes impossible, to trace designs to their birth-places, although there can be no doubt that a knowledge of the fauna, the flora, and ethnology of a district is of the greatest assistance in the search. The author agrees with others in thinking that many of the simpler designs may have arisen independently in different quarters of the globe, such, for instance, as the scroll design.

A student of the more æsthetic side of art, however, might have some objections to offer to certain parts of the book. He would object, probably, to the classification Professor Haddon gives of the reasons for which objects are decorated. The reasons given are (1) for *art*, (2) for *information*, (3) for *wealth*, and (4) for *religion*. Art here stands for any combination of line, form, and colour, giving a pleasurable sensation. It is this pleasurable sensation that calls all decorations into existence, and this is the only reason for the decoration of objects. Information, wealth, and religion do preserve and keep designs and devices in existence, but when designs become utilised with these significations they then cease in reality to be decorations. Such a student might also carp somewhat at the title of the book; *art* and *evolution* have become words of so loose connotation that they are almost as conventional and meaningless as some of the designs dealt with by the author. The student of the æsthetic side of art, also, would be inclined to think that Professor Haddon claims rather too much for Biology and its methods. It is quite true that designs are the outcome of the living protoplasm of the human brain, but if for this reason biologists are to claim art as a department of their subject, then must mathematics, physics, history, and every science and art that the human mind deals with, fall to their share. Nor is there anything peculiar in the methods of the biologist; he uses his eyes, makes records, collects facts, and draws deductions just as every other scientist does. But this book may be taken as a proof that there is no reason why a biologist may not be a successful student of art and write a book upon the subject charmingly free from all self-seeking, and making full and open acknowledgment of the debt he owes to the observations and conclusions of men that have already worked at this subject.

APPENDIX II.

CHEMICAL LITERATURE FOR MAY, 1896.

Vol. i. No. 5. *American Journal of Science.* (May, 1896.)

Trowbridge, J., Carbon and Oxygen in the Sun (pp. 329-333). *Washingon, H. S.*, Ischian Trachytes (pp. 375-386). *Lea, M.C.*, Numerical Relations existing between the Atomic Weights of the Elements (pp. 386-389). *Palache, C.*, Crocoite from Tasmania (pp. 389-391).

Vol. xviii. No. 5. *Journal of the American Chemical Society.* (May, 1896.)

De Chalmot, G., Hydrofluoric Acid (pp. 415-425). *Coates, C. E.*, and *Dodson, W. R.*, Nitrogen Assimilation in the Cotton Plant (pp. 425-428). *Wiley, H. W.*, and *Ewell, E. E.*, Determination of Lactose in Milks by Double Dilution and Polarisation (pp. 428-434). *Venable, F. P.*, and *Clarke, T.*, A Study of the Zirconates (pp. 434-445). *Winton A. L.*, A Modified Ammonium Mobybdate Solution (pp. 445-446). *Gladding, T. S.*, On the Estimation of Sulphur in Pyrites (pp. 446-449). *De Schweinitz, E. A.*, and *Dorsett, M.*, Further Notes upon the Fats contained in the Tuberculosis Bacilli (pp. 449-451). *McIlhiney, P. C.*, The Cassel-Hinman Gold and Bromine Process (pp. 451-457). *Lord, N. W.*, A Simple Method for Determining the Neutrality of the Ammonium Citrate Solution used in the Analysis of Fertilisers (pp. 457-458). *Low, A. H.*, The Copper Assay by the Iodide Method (pp. 458-462). *Shorey, E. C.*, On Two Sources of Error in Sugar House Analyses (pp. 462-466).

Vol. xviii. No. 4. *American Chemical Journal.* (April, 1896.)

Fay, H., The Action of Light on some Organic Acids in the Presence of Uranium Salts (pp. 269-290). *Herty, C. H.*, A Review of Some Recent Work on Double Halides (pp. 290-294). *Campbell, E. D.*, and *Hart, E. B.*, On the Quantitative Determination of Hydrogen by Means of Palladous Chloride (pp. 294-298). *Jackson, C. L.*, and *Calvert, C.*, On the Behaviour of Certain Derivatives of Benzol Containing Halogens (pp. 298-312). *Orndorff, W. R.*, and *Howells, V. A.*, The Cis and Trans Modification of Benzene Hexabromide (pp. 312-319). *De Chalmot, G.*, Silicide of Calcium (pp. 319-321). *Jones, H. C.*, and *Allen, C. R.*, The Conductivity of Yttrium Sulphate (pp. 321-323). *Walker, M. S.*, The Practical Use in the Chemical Laboratory of the Electric Arc obtained from the Low Potential Alternating Current (pp. 323-328). *Keiser, E. H.*, The Preparation of Allylene, the Action of Magnesium upon Organic Compounds (pp. 328-332). *Dunlap, F. L.*, The Action of Urea and Sulphocarbanilide on Certain Acid Anhydrides (pp. 332-341).

Vol. xviii. No. 5. (May, 1896.)

Remsen, I., and *Muckenfuss, A. M.*, Transformations of Parasulphaminebenzoic Acid under the Influence of Heat (pp. 349-365). *Kortright, F. L.*, The Heat of Electrolytic Dissociation of Some Acids (pp. 365-372). *Lachman, A.*, On the Existence of Pentaethyl Nitrogen (pp. 372-375). *Jones, H. C.*, and *Allen, C. R.*, The Conductivity of Solutions of Acetylene in Water (pp. 375-377). *Jones, H. C.*, and *Allen, C. R.*, The Use of Phenolphthalein in Illustrating the Dissociating Action of Water (pp. 377-381). *Wheeler, H. L.*, and *Boltwood, B. B.*, The Action of Acid Chlorides on the Silver Salts of the Anilides (pp. 381-390). *Howe, W. T. H.*, On the Existence of Two Orthophthalic Acids (pp. 390-401). *Morse, H. N.; Hopkins, A. J.;* and *Walker, M. S.*, The Reduction of Permanganic Acid by Manganese Superoxide (pp. 401-420).

Vol. xxi. No. 242. *The Analyst.* (May, 1896.)

Pearmain, T. H., and *Moor, C. G.*, The Bacteriological Examination of Water for the Typhoid Bacillus (pp. 117-122). *Sykes, W. J.*, and *Mitchell, C. A.*, The Estimation of the Diastatic Power of Malt, etc. (pp, 122-128). *Shepherd, H. H. B.*, Official Methods for the Analysis of Fertlizers, issued by the German Manure Manufacturers Association (pp. 128-133). *Reed, L.*, Tropaeölins in Milk, etc. (p. 140).

Vol. xv. No. 4. *Journal of the Society of Chemical Industry*. (30th April, 1896.)

Sindall, R. W., Moisture in Wood Pulp (pp. 239-245). *Smith, W.*, A Study of Comparative Affinities in the case of Certain Salts of Ammonium and Wool. II. (pp. 245-247). *Herman, D.*, On Poisoning by Gas: its Prevention and Cure (pp. 247-248). *Kohn, C. A.*, A Modified Form of Schrötter's Apparatus for the Determination of Carbonic Anhydride (p. 248). *Beveridge, J.*, The Wood Cellulose Industry of Scandinavia (pp. 249-251). *Beveridge, J.*, On a Method of Calculating the Amount of Steam required to Dry a Ton of Paper or Pulp (pp. 251-252). *Hart, P.*, Description of a Simple Feed-Water Heater (pp. 252-253). *Flintoff, R. J.*, The Functions of Albumin as a Fixing Agent for Pigments on Cotton (pp. 253-254). *Barnes, J.*, On the Preparation of Water Free from Ammonia (pp. 254-255). *Clark, J.*, Estimation of Antimony in Ores and Metals (pp. 255-257). *Dewey, F. P.*, The Sulphuric Acid Process of Refining Lixiviation Sulphides (pp. 257-260).

Vol. xli. No. 252. *Philosophical Magazine and Journal of Science*. (May, 1896.)

Shields, J., A Mechanical Device for Performing the Temperature Corrections of Barometers (pp. 406-414). *Wood, R. W.*, On the Absorption Spectrum of Solutions of Iodine and Bromine above the Critical Temperature (pp. 423-431). *Trowbridge, J.*, Carbon and Oxygen in the Sun (pp. 450-454).

Vol. lix. No. 356. *Proceedings of the Royal Society*. (30th April, 1896.)

Wildermann, M., A new Method of determining Freezing Points (pp. 251-254). *Collie, J. N.* and *Ramsay, W.*, On the Behaviour of Argon and Helium when submitted to the Electric Discharge (pp. 257-270). *Gamgee, A.*, On the Absorption of the extreme Violet and ultra-Violet Rays of the Solar Spectrum by Haemoglobin, its Compounds, and certain of its Derivatives (pp. 276-279).

Tome viii. Series 7. *Annales de Chimie et de Physique*. (May, 1896.)

Parenty, H., Sur le débit des gaz parfaits et de la vapeur d'eau sous pression à travers les orifices (pp. 5-79). *Varet, R.*, Recherches sur les sels de mercure (pp. 79-141). *Moissan, H.*, Étude sur l'argon (pp. 141-144).

Tomes xv.-xvi. No. 8. *Bulletin de la Société Chimique de Paris*. (20th April, 1896.)

Thomas, V., Action du peroxyde d'azote et de l'air sur le chlorure de bismuth (pp. 469-472). *Granger, A.*, Sur un sulfophosphure d'étain (pp. 472-474). *Guye, A.*, et *Jordan, C.*, Recherches expérimentales sur les butanol- 2- oïques (α-oxybutyrique) actifs (pp. 474-498). *Marie, E.*, Éthers glycériques des acides cérotique et mélissique (pp. 498-503). *Marie, T.*, Chlorures d'acides, amides, nitriles des acides cérotique et mélissique (pp. 503-508). *Marie, T.*, Sur l'oxydation des acides des graisses (pp. 508-510). *Marie, T.*, Sur les propriétés des acides cérotique et mélissique existant à l'état libre dans la cire d'abeilles (pp. 510-514). *Vaillant, V.*, Sur quelques dérivés métalliques de la dithioacétylacétone (pp. 514-519). *Marcourt, E.*, Étude chimique d'un nouveau composé d'antipyrine at d'aldéhyde formique (pp. 520-529). *Reychler, A.*, Étude sur un dibromure de camphène (pp. 529-530). *Scheurer-Kestner*, Sur la détermination de l'acidité des produits pyroligneux (pp. 530-536).

Tomes xv.-xvi. No. 9. (5th May, 1896.)

Tassilly, Thermochimie. Etude thermique de quelques oxybromures (pp. 553-555). *Guinchant*, Lois de décomposition des sels par l'eau (pp. 555-560). *Lepierre, C.*, Analcime, sa constitution (pp. 561-565). *Marie, T.*, Sur les formules des acides cérotique et mélissique extraits de la cire d'abeilles (pp. 565-569). *Marie, T.*, Dérivés bromés des acides cérotique et mélissique (pp. 569-575). *Marie, T.*, Acides alcools et acides amines dérivés des acides cérotique et mélissique (pp. 576-583). *Marie*, T., Dérivés cyané, amidé et bibasique de l'acide cérotique (583-590). *Marie, T.*, Comparaison entre les dérivés des acids des cires et les dérivés des acides des graisses (pp. 590-591). *Bertrand, G.*, Observations sur quelques nouveaux dérivés de la série des pentoses ; l'acide lixonique et la lixite (pp. 592-594). *Barbier, P.*, et *Bouveault, L.*, Action du

gaz chlorhydrique sur le licaréol, le licarhodol et le lémonol; rapports entre ces trois alcools (pp. 594-597). *Gossart, E.*, Méthode pour la recherche des falsification des essences végétates (pp. 597-609). *Patein, G.*, et *Dufau, E.*, Des combinaisons de l'antipyrine avec les crésylols (pp. 609-610). *Patein, G.* et *Dufau, L.*, Action de l'antipyrine sur deux dérivés des diphénols (pp. 611-612). *Bouchardat, G.*, et *Tardy*, Sur l'essence d'anis de Russie (pp. 612-617).

Tome cxxii. No. 15. *Comptes Rendus hebdomadaires de l'Académie des Sciences.* (13th April, 1896.)

Schloesing, T., Les nitrates dans les eaux de source (pp. 824-829). *Gréhant, N.*, Sur les produits de combustion d'un bec à acétylène—Mélange explosifs d'acétylène et d'air (pp. 832-833). *Barbier, P.*, et *Bouveault, L.*, Sur l'homolinalcool et sur la constitution du licaréol et du licarhodol (pp. 842-844). *Favrel, G.*, Action des cynacétates de propyle, de butyte et d' amyle sodés, sur le chlorure de diazobenzène (pp. 844-846).

Tome cxxii. No. 16. (20th April, 1896.)

Haller, A., Extraction des alcools terpéniques contenus dans les huiles essentielles (pp. 865-869). *Guye, P. A.*, et *Jordan, C.*, Dispersion rotatoire des corps actifs liquides non polymérisés (pp. 883-886). *Ferrand*, Sur une nouvelle série de sulfophosphures (pp. 886-889).

Tome cxxii. No. 17. (27th April, 1896.)

Guye, P. A., et *Goudet, C.*, Superposition optique de six carbones asymétriques dans une même molécule active (pp. 932-935). *Didier, G.*, Sur un azotate basique de magnésie (pp. 935-936). *Granger, A.*, Sur le sesquiphosphure de fer cristallisé (pp. 936-937). *Gassmann, C.*, Étude sur le péridinitronaphtalène (pp. 937-940). *Causse, H.*, Sur le tartrate du phényl-hydrazine et ses dérivés (pp. 940-943). *Guinchant*, Chaleur de combustion des dérivés cyanés (pp. 943-946). *Sorel, E.*, Sur la distillation des premiers acides de la série grasse (pp. 946-948). *Friedel, G.*, Sur les zéolithes et la substitution de diverses substances à l'eau qu'elles continnent (pp. 948-951). *Henry, C.*, Sur la détermination par une méthode photométrique nouvelle, des lois de la sensibilité lumineuses aux noirs et aux gris (pp. 951-954). *Gérardin, A.*, et *Nicloux, M.*, Mesure des odeurs de l'air (pp. 954-955).

Tome cxxii. No. 18. (4th May, 1896.)

Bertrand, J., Sur la théorie des gaz (pp. 963-967). *Cazeneuve, P.*, Sur un nouveau mode de préparation synthétique de l'urée et des urées composées symétriques (pp. 999-1000). *Arnaud, A.*, Transformation de l'acide taririque et de l'acide stéaroléique en acide stéarique (pp. 1000-1002). *Bourquelot, E.*, Sur la présence, dans le *Monotropa Hypopithys*, d'un glucoside de l'éther méthylsalicylique et sur le ferment hydrolysant de ce glucoside (pp. 1002-1004). *Balland*, Sur le maïs (pp. 1004-1006).

16e Année. Tome iii. No. 8. *Journal de la Pharmacie et de Chimie.* (15th April, 1896.)

Bourquelot, E., Sur l'hydrolyse du raffinose (mélitose) (pp. 390-394). *Maljean*, Emulsion de l'huile de houille par la poudre de marron d'Inde (pp. 394-395). *Maljean*, Quelques dosages de matières tanantes (pp. 395-396). *Prunier, L.*, Essai des bromures officinaux (pp. 396-400). *Bouchardat, G.*, et *Tardy*, Sur l'essence d'anis de Russie (pp. 400-402).

16e Année. Tome iii. No. 9. (1st May, 1896.)

Causse, Sur le dosage du glucose (pp. 433-434). *Pajot*, Une falsification dans le commerce des graines de colza (pp. 434-437). *Chicote, C.*, Note historique au sujet des vins plâtres (pp. 437-438).

Tome xxviii. No. 2. *Journal de la Société Physico-Chimique Russe.*

Hardin, D., G. Porschneff (nécrologie) (pp. 117-119). *Lunge, G.*, A la mémoire du Dr. G. Porschneff (pp. 119-120). *Hinzberg, A.*, Sur la deshydratation du trioxyhexahydrocymol (pp. 120-122). *Ertschikoffsky, G.*, Action de l'acide acétique sur le pinène (pp. 122-132). *Godlevski, I.*, Sur l'oxydation du limonène (pp. 132-140). *Lagorio, A.*, Sur la forme crystallographique de l'acide oxyterpenilique (pp. 140-143). *Wagner, G.*, Recherche de

l'agrostemme dans la farine (pp. 143-149). *Reformatsky, S.*, Sur la préparation de l'acide αα-diméthylglutarique (pp. 149-159). *Dain, G.*, Action du zinc et de l'éther bromoisobutyrique sur l'aldehyde benzoique (pp. 159-175). *Jacovkin, A.*, Sur la répartition d'un composé entré deux dissolvants (pp. 175-186). *Soboleff, M.*, Sur les proprietés de l'acide phospho- 12- wolframique (pp. 186-207). *Beketoff, N.*, Sur le changement du volume ayant lieu lors de la formation de l'iodure d'argent en partant des éléments; *Kournakoff, N.*, Sur la structure des formes les plus complexes des composés chimiques; *Gvosdareff, N.*, Sur les combinaisons ethylènediamidiques de palladium; *Zelinsky, N.*, et *Tchernosvitoff, N.*, Sur les acides diméthyltricarballyliques; *Rabinovitsch, I.*, Analyse de l'eau du lac salé de Golopristan; *Tschernik, G.*, Sur un mineral ceritique du district de Batoum; *Dementieff, K.*, Dosage volumetrique du zinc (pp. 207-222).

Band ccxci. Heft 1 und 2. *Justus Liebig's Annalen der Chemie.* (14th April, 1896.)

Graebe, C., und *Stindt, H.*, Ueber Dibiphenylenäthen und Dibiphenyläthan (pp. 1-8). *Graebe, C.*, und *Ullmann F.*, Ueber o- Aminobenzophenon (pp. 8-16). *Graebe, C.* und *Ullmann, F.*, Ueber eine neue Carbazolsynthese (pp. 16-17). *Ullmann, F.*, Ueber Reduction der o- Benzoyl- benzoësäure (pp. 17-25). *Claisen, L.*, Beiträge zur Kenntniss der 1, 3- Diketone und verwandter Verbindungen. II. (pp. 25-137). *Brühl, J. W.*, Spectrochemische Untersuchung des α- und β- mesityloxydoxalsauren Methyls und Aethyls von Claisen (pp. 137-147). *Wislicenus, W.*, Uber die Isomerie der Formylphenylessigester (pp. 147-217). *Brühl, J. W.*, Spectrochemische Untersuchung des α- und β- Formylphenylessigesters (pp. 217-226). *Wolff, L.*, Ueber Tetronsäure (pp. 226-252).

Band ccxci. Heft 3. (28th April, 1896.)

Kolb, A., Ueber einige Derivate des Phenylacetons (pp. 253-297). *Einhorn, A.*, Ueber die Reduction der Phenolcarbonsäuren. II. (pp. 297-305). *Hesse, O.*, Ueber die Wurzel von *Rumex nepalensis* (pp. 305-313). *Zincke, T.*, Ueber Azimido- verbindungen IV. (pp. 313-342). *Wallach, O.*, Zur Kenntniss der Terpene und der ätherischen Oele (pp. 342-367). *Schiff, H.*, Benzalbiuret und verwandte Verbindungen (pp. 367-377) *Ostrogovich, A.*, Acetyl- und Benzoylbiuret (pp. 377-380).

Band ccxxxiv. Heft 4. *Archiv de Pharmacie.* (5th May, 1896.)

Peinemann, K., Beiträge zur pharmacognostichen und chemischen Kenntnis der Cubebe und der als Verfälschung derselben beobachteten Piperaceenfrüchte (pp. 241-272). *Lewin, L.*, Uber eine forensische Strychninuntersuchung (pp. 272-273). *Kiliani, H.*, Ueber den Nachweis der Digitalis-glycoside und ihrer Spaltungsprodukte durch eisenhaltige Schwefelsäure (pp. 273-278). *Mjöen, J. A.*, Ueber das fette Oel des *Secale cornutum* (pp. 278-283). *Mjöen, J. A.*, Ueber das fette Oel der Samen von *Strophantus hispidus* (pp. 283-286). *Mjöen, J. A.*, Ueber das fette Oele der Samen von *Hyoscyamus niger* (pp. 286-289). *Balzer, A.*, Ueber das Sandaracharz (pp. 289-317). *Otto, R.*, Das Verhalten des Papaverins und Narkotins bei dem Stas - Otto'schen Verfahren der Ausmittelung der Alkaloide (pp. 317-320).

Jahrgang xxix. No. 7. *Berichte der Deutschen Chemischen Gesellschaft.* (27th April, 1896.)

Jackson, C. L., und *Comey, A. M.*, Ueber die Einwirkung von Salpetersäure auf Kaliumkobalticyanid (pp. 1020-1023). *Traube, J.*, Molekularvolumetrische Methode der Molekulargewichts bestimmung. III. (pp. 1023-1030). *Marchlewski, L.*, Zur Kenntniss des Isatins (pp. 1030-1034). *Tanatar, S.*, Ueber die Bildungsweise der Soda in der Natur (pp. 1034-1039). *Tanatar, S.*, Notiz ueber untersalpetrige Säure (pp. 1039-1040). *Preyer, W.*, Argon und Helium im Systeme der Elemente (pp. 1040-1042). *Conrad, M.*, Ueber halogensubstituirte Acetessigester (pp. 1042-1048). *Eckenroth, H.*, und *Koerppen, G.*, Ueber einige Derivate des o- Benzöesäuresulfinids (Saccharin) (pp. 1048-1052). *Bamberger, E.*, Berichtigung (pp. 1052-1053). *Schuster, A.*, und *Pinnow, J.*, Ueber Derivate des α-Diamidodimethylanilins (pp. 1053-1057). *Hantzsch, A.*, und *Gerilowski, D.*, Notiz betr. die Ionenzahl der diazosulfonsauren Salze (pp. 1057-1059). *Hantzsch, A.*, Zur Kenntniss normaler Diazometallsalze (pp. 1059-1067). *Hantzsch, A.*, Ueber das diazonium (pp. 1067-1074). *Gerilowski, D.*, Ueber stereoisomere Salze der Ortho-diazo-

benzol ortho-sulfonsäure (pp. 1075-1078). *Baeyer, A.*, Ortsbestimmungen in der Terpenreihe (pp. 1078-1084). *Paal, C.*, Ueber die Desamidirung des Glutinpeptons (pp. 1084-1095). *Auwers, K.*, Ueber Dibrompseudocumenolbromid und Analoge Verbindungen (pp. 1095-1110). *Auwers, K.*, und *Hof, L.*, Ueber Dibrompseudocumenolbromid, -chlorid und -jodid (pp. 1110-1120). *Auwers, K.*, und *Senter, H, A.*, Ueber die Umsetzungsproducte des Dibrompseudocumenolbromids mit aromatischen Basen (pp. 1120-1129). *Auwers*, K., und *Camphenhausen, G. F.*, Ueber Bromderivate des as- m-Xylenols (pp. 1129-1132). *Lovén, J. M.*, Stereoisomere Thiodilactylsäure (pp. 1132-1136). *Lovén, J. M.*, Ueber Thiodihydracrylsäure (Propansäurethio- 3. 3- propansäure) und β-Sulfodipropionsäure (Propansäure- sulfon- 3. 3- propansäure) (pp. 1136-1139). *Lovén, J. M.*, Einige in Bezug auf den Schwefel unsymmetrische Homologe der Thiodiglycolsäure und der Sulfodiessigsäure (pp. 1139-1134). *Precht, J.*, Ueber eine Abhanderung der von Baboschen Wasserquecksilberlufthumpe zur Erzeugung hoher Luftverdünnungen (pp. 1143-1146). *Werner, A.*, Ueber Stereoisomere bei Derivaten de Benzhydroxamsäure. III. (pp. 1146-1153). *Werner, A.*, und *Subak, J.*, Ueber Stereoisomere bei Derivaten der Benzhydroxamsäure. IV. (pp. 1153-1161). *Werner, A.*, und *Gemeseus, A.*, Ueber Aethylendihydroxylamin (pp. 1161-1164).

Jahrgang xxix. No. 8. (11th May, 1896.)

Curtius, T., und *Clemm, H.*, Erstatz von Carboxyl durch Amid in mehrbasischen Säuren (pp. 1166-1168). *Schmidtmann, H.*, Ueber einige Derivate des Malonitrils (pp. 1168-1175). *Roth, W.*, Ueber β- Naphtyl- piperidin und β- Naphtyl- α- pipecolin (pp. 1175-1182). *Pictet, A.*, und *Hubert, A*, Ueber eine Neue Synthese der Phenanthridinbasen (pp. 1182-1189). *Pictet, A.*, Ueber eine eigenthümliche Bildung des Acridons (pp. 1189-1192). *Fichter, F.*, und *Herbrand, A.*, Ueber eine neue Darstellungsweise einiger Lactone der Fettreihe (pp. 1192-1195). *Ginzberg, A.*, Ueber Sobrerol (Δ- Menthen- 2.8.- diol) (pp. 1195-1198). *Ginzberg, A.*, Zur Dehydratation des Menthan- 1.2.8- triols (pp. 1198-1202). *Tollens, B.*, Ueber den Nachweis der Pentosen mittels der Phloroglucin- Salzsäure- Absatz- Methode (pp. 1202-1210). *Söderbaum, H. G.*, Neue Condensationsproducte des Diphenyloxäthylamins (pp. 1210-1216). *Ciamician, G.*, und *Silber, P.*, Zur Kenntniss der Tropinsäure (pp. 1216-1218). *Nef, J. W.*, Ueber die Einwirkung von Aethylchloriden auf die Salz der Nitroparaffine (pp. 1218-1224). *Goldschmidt, H.*, und *Girard, O.*, Kryoskopische Versuche mit Phenolsalzen (pp. 1224-1243). *Gassmann, C.*, Zur Kenntniss des Peridinitronaphtalins (pp. 1243-1246). *Kehrmann, F.*, und *Bürgin, H.*, Zur Constitution der Fluorindine. III. (pp. 1246-1254). *Ladenburg, A.*, Das specifische Drehungsvermögen der Pyroweinsäure (pp. 1254-1255). *Auwers, K.*, Ueber Indazolderivate (pp. 1255-1272). *Sondheimer, A.*, Zur Kenntniss eines Körpen mit *achtgleidrigen* Ringe (pp. 1272-1276). *Bischoff, C. A.*, Studien ueber Verkettungen. VII. Kuppelung von Malonsäureestern mittels einfacher Bindungen (pp. 1276-1280). *Bischoff, C. A.*, VIII. Kupplung von Malonsäuredimethylestern mittels doppelter Bindung (pp. 1280-1286). *Bischoff, C. A.*, IX. Kupplung von Malonsäurediäthylester mittels doppelter Bindung (pp. 1286-1293), *Markcwald, W.*, Ueber das Isopipecolin Ladenburg's (pp. 1293-1297). *Tanatar, S.*, Die Umwandlung des Trimethylens in Propylen (pp. 1297-1300). *Gabriel, S.*, und *Stelzner, R.*, Zur Kenntniss der Chinazolinverbindungen (pp. 1300-1316). *Krafft, F.*, und *Weilandt, H.*, Siedetemperaturen beim Vacuum des Kathodenlichts (pp. 1316-1328). *Krafft, F.*, und *Strutz, A.*, Ueber das Verhalten seifenähnlicher Substanzen gegen Wasser (pp. 1328-1334). *Krafft, F.*, Ueber eine Theorie der colloïdalen Lösungen (pp. 1334-1344).

Band liii. Nos. 6-7. *Journal für Praktische Chemie.* (10th April, 1896.)

Ipatiew, W., Ueber die Einwirkung von Brom auf tertiäre Alkohole der Reihe ($C_n H_{2n+2} O$) (pp. 257-288). *Schneider, R.*, Ueber das Atomgewicht des Wolframs (pp. 288-303). *Emery, W. O.*, Ueber zwei isomere Ketodicarbonsäuren (pp. 303-308). *Emery, W. O.*, Zur Einwirkung von β- Bromlävulin- Säureester auf Natriummalonsäureester (pp. 308-312). *Emery, W. O.*, Uber α- und β- Benzoyl- tricarballylsäureester (pp. 312-314). *Thudicum, J. L. W.*, Ueber die Reactionen des Bilirubins mit Jod und Chloroform (pp. 314-325). *Claus, Ad.*, Zur Kenntniss des Carbostyrils und seiner Derivate, ein Beitrag zur Lösung der Tautomeriefrage (pp. 325-335). *Claus, Ad.*, Zur Kenntniss des ana-Oxychinolins (pp. 335-340). *Zincke, T.*, Ueber o- Dinitroso- verbindungen der Benzolreihe (pp. 340-344). *Von Meyer, E.*, Zur Kenntniss des Mandelsaurenitrils (p. 344).

Band xvii. Heft 1. *Monatshefte für Chemie und verwandte Thiele anderer Wissenschaften.* (March, 1896.)

Senkowski, M., Zur Kenntniss der Constitution der Cholsäure (pp. 1-4). *Georgievics, G. v.* Zu Kenntniss der gefärbten Rosanilinbasen (pp. 4-13). *Meyerhoffer, W.*, Ueber reciproke Salzpaare I. (pp. 13-29). *Mauthner, J.*, und *Suida, W.*, Beiträge zur Kenntniss des Cholesterins III. (pp. 29-50). *Eder, J. M.*, und *Valenta, E.*, Ueber drei verschiedene Spectren des Argons (pp. 50-57). *Jeiteles, B.*, Ueber die Destillation von o- Kresol mit Bleioxyd (pp. 57-65). *Jeiteles, B.*, Notiz, ueber das Verhalten von phenylsalicylsaurem Calcium bei der trochenen Destillation (pp. 65-68). *Lieben, A.*, Ueber die durch Einwirkung von alkoholischen Kali auf Aldehyde entstehenden zweiwerthigen Alkohole (pp. 68-76). *Just, A.*, Einwirkung von alkoholischen Kali auf ein Gemenge von Formaldehyd und Isobutyraldehyd (pp. 76-85). *Franke, A.*, Ueber das aus dem Isobutyraldehyd entstehende Glykol und dessen Derivate (pp. 85-102). *Cohn, P.*, Ueber o- Benzoylphenol (pp. 102-109).

Jahrgang xxxv. Heft 2. *Zeitschrift für Analytische Chemie.* (April, 1896.)

Behrens, H., Zur mikrochemischen Unterscheidung von Cinchonidin und Homocinchonidin (pp. 133-143). *Ruoss*, Eine allgemeine volumetrische Bestimmung der durch fixe äbzende oder kohlensaure Alkalien fällbaren Metalle (pp. 143-159). *Stutzer, A.*, und *Maul, R.*, Untersuchung von Feinsprit auf dessen Gehalt an Fuselöl (pp 159-163). *Vaubel, W.*, Zur Gehaltsbestimmung von Benzidin und Tolidin (pp. 163-164). *Vaubel, W.*, Ueber das Verhalten der Naphtole und Naphtylamine gegen nascirendes Brom (pp. 164-166). *Strohl, A.*, Jodzahl und Brechungsindex der Cacaobutter (pp. 166-169). *Greiner* und *Freidrichs*, Aräometer- Pipette (pp. 169-170). *Bornträger, H.*, Ein Verfahren zur Auflösung des geglühten Eisenoxydes und anderer Metalloxyde (p. 170). *Fresenius, R.*, und *Hintz, R.*, Ueber eigenthümliche Löslichkeitsverhaltnisse des schwefelsauren Baryts (pp. 170-184).

Band xii. Heft 1. *Zeitschrift für Anorganische Chemie.* (11th April, 1896.)

Thomsen, J., Experimentelle Untersuchung ueber die Dichte des Wasserstoffes und des Sauerstoffe (pp. 1-16). *Sobolew, M.*, Ueber einige physikalische Eigenschaften der Phosphor 1.2. Wolframsäure (pp. 16-39). *Goldhammer, D. A.*, Bemerkungen ueber die analytische Darstellung des periodischen Systems der Elemente (pp. 39-46). *Werner, A.*, Ueber eine eigentümliche Klasse von Platinverbindungen und die sogenannten isomeren Platosoxalsäuren (pp. 46-55). *Hofmann, K. A.*, Einé neue Persulfomolybdänsäure (pp. 55-63).

Band xix. Heft 4. *Zeitschrift für Physikalische Chemie.* (1st May, 1896.)

Luther, L., Elektromotorische Kraft und Verteilungsgleichgewicht (pp. 529-572). *Ihle, R.*, Ueber die Bildung von Ammoniak bei der Elektrolyse der Saltpetersäure (pp. 572-577). *Ihle, R.*, Ueber die katalytische Wirkung der salpetrigen Säure und das Polential der Salpetersäure (pp. 577-592). *Tafel, J.*, Ueber die sogenannte "indirekte Esterbildung" (pp. 592-599). *Noyes, A. A.*, Die katalytische Wirkung der Wasserstoffionen auf polymolekular Reaktionen (pp. 599-607). *Wald, F.*, Die Genesis der stöchiometrischen Grundgesetze. II. (pp. 607-625). *Kenrich, F. B.*, Die Potentialsprünge zwischen Gasen und Flüssigkeiten (pp. 625-657). *Friedländer, S.*, Ueber Argon (pp. 657-668). *Wagner, M.*, Die Zersetzungsgeschwindigkeiten der Schwefel-stickstoffsäuren (pp. 668-689). *Wood, R. W.*, Ueber die Absorptionsspektren der Lösungen von Jod und Brom ueber der Kritrischen Temperatur (pp. 689-696). *Tanatar, S.*, Die Lösungs- und Neutralisationswärme des Nitroharnstoffes und seines Kaliumsalzer (pp. 696-699). *Schall, C.*, Nachtrag zur letzten Abhandlung (pp. 699-709).

Anno xxvi. Vol. i. Fascicolo 2. *Gazzetta Chimica Italiana.* (22nd March, 1896.)

Moro, P., Ricerche sull'acido naftalindicarbonico 1-5 e suoi derivati (pp. 89-116). *Zoppellari, I.*, Sopra alcuni fenomeni osservati nel congelamento di soluzioni diluite (pp. 116-119). *Carrara, G.*, Per la teoria della dissociazione elettrolitica in solventi diversi dall'aqu. I. Alcool metitico (pp. 119-197).

Anno xxvi. Vol. i. Fascicolo 3. (6th April, 1896.)

***Errera**, G.*, Metodo generale di preparazione delle α- bialchilidantoine (pp. 197-211). *Antony, U.*, e *Lucchesi, A.*, Considerazioni per la precipitazione di solfuri di platino. Solfuro di platino colloidale (pp. 211-218). *Antony, U.*, e *Benelli, T.*, Ricerca delle piccole quantita di piombo nelle acque (pp. 218-220). *Tarugi, N.*, Per la ricerca dei cromati e degli arseniti (pp. 220-222). *Grande, E.*, Contribuzione alla conoscenza degli eteri della fenolftaleina (pp. 222-231). *Gennari, G.*, Sulla velocita di saponificazione in solventi organici (pp. 231-237). *Salvadori, R.*, Dissociazione elettrolitica in relazione colle variazioni della temperatura. I. Studi crioscopici ea ebullioscopici sopra le soluzioni acquose ed in alcool melitico di alcuni cloruri (pp. 237-255). *Zoppellari, I.*, Sopra il comportamento crioscopici e la composizione di alcuni acetati di basi deboli (pp. 255-264). *Errera, G.*, e *Berti, E.*, Derivati della fenolftaleina (pp. 264-274). *Longi, A.*, e *Mazzolino, G.*, Sulla prebesa combinazione del cianoforme coll'joduro mercurico (pp. 274-280).

APPENDIX I.

NOTICES OF BOOKS.

Grundriss der Krystallographie für Studirende und zum Selbstunterricht. By Gottlob Linck. Jena, 1896. Pp. vi. and 252.

The great and ever-increasing importance of the position held by crystallography as an auxiliary to the kindred sciences of physics and chemistry is gradually receiving recognition. Indications are not wanting that in the future many of the problems of molecular physics relating to solid bodies will be found easily susceptible to attack by crystallographic methods, so that crystallography will at length take its legitimate position as a branch of physical chemistry. With these prospects, we gladly welcome any book in which crystallography is rationally discussed as a living science, which embraces a remarkably fertile and hitherto comparatively unexploited field.

In the preface to the present volume, the author states that his work is designed for the perusal of young students; and, in spite of what appear to us serious defects, the book is of an extremely readable character, and its language so clear and simple, that the author's design is, on the whole, well carried out. We find, however, no mention of the stereographic projection throughout the work, and an English reader can scarcely conceive of a student attaining to an appreciative grasp of elementary crystallography, without early acquiring an easy facility in the use of that simple and invaluable aid. Surely, too, the time has come when Naumann's cumbrous method of describing forms might well be consigned to the crystallographic historian, and be entirely omitted from educational works. Here, however, the author assigns to it equal prominence with the more significant and elegant Millerian method.

That portion of the work which deals with the geometrical properties of crystals is concise and well arranged. The method of treating the hexagonal system is, however, unsatisfactory, the reader being left with very vague notions respecting the precise meaning and character of the axial system employed. The treatment of crystallographic optics is clear, and, for an elementary manual, leaves little to be desired. The chapter dealing with polymorphism, isomorphism, morphotropy, etc., is a very praiseworthy innovation in a work of this kind; it treats briefly and concisely of the relations existing between chemical composition and crystalline form.

The book is well printed and amply illustrated with diagrams of a distinctly superior character to those which we are accustomed to see copied from one work into another, *ad nauseum;* a coloured diagram of interference figures ends the book.

The following list of errata may be of service :—

P.	6,	line	12	from	below,	*read*	Krystallsystem.
,,	36,	,,	14	,,	above,	,,	Triakisoctaëder.
,,	43,	,,	17	,,	below,	,,	einander.
,,	64,	,,	11	,,	above,	,,	Nebensym.
,,	188,	,,	9	,,	below,	,,	chroïsmus.
,,	190,	,,	18	,,	,,	,,	$Mg\,Al_2\,O_4$.
,,	192,	,,	21	,,	above,	,,	nach.
,,	,,	,,	35	,,	,,	,,	convergent.
,,	193,	,,	16	,,	,,	,,	gewöhnlichem.
,,	195,	,,	22	,,	below,	,,	differenz.
,,	198,	,,	33	,,	above,	,,	441.
,,	203,	,,	14	,,	,,	,,	isotropen.
,,	240,	,,	13	,,	below,	,,	Auslöschungs.

APPENDIX II.

CHEMICAL LITERATURE FOR JUNE, 1896.

Vol. xxi. No. 243. *The Analyst.* (June, 1896.)

Pearmain, T. H., and *Moor, C. G.*, The Bacteriological Examination of Water for the Typhoid Bacillus (pp. 141-148). *Smith, H. M.*, Note on the Estimation of Formic Aldehyde (pp. 148-151). *Shepherd, H. H. B.*, Official Methods for the Analysis of Fertilizers, issued by the German Manure Manufacturer's Association (pp. 151-156). *McGill, H.*, Note on the Use of the Westphal Balance (pp. 156-157). *Leonard, N.*, Note on Hehner's Test for Formic Aldehyde (pp. 157-158).

Vol. lxix. No. 402. *Journal of the Chemical Society.* (May, 1896.)

Collie, J. N., and *Wilsmore, N. T. M.*, The Production of Naphthalene and of Isoquinoline Derivatives from Dehydracetic Acid (pp. 293-304). *Lapworth, A.*, and *Kipping, F. S.*, Isomeric π-Bromo-α-Nitrocamphors (pp. 304-322). *Lapworth, A.*, Note on the Formation of Camphorquinone from α-Chloronitrocamphor (pp. 322-324). *Doran, R. E.*, The Action of Lead Thiocyanate on the Chlorocarbonates. I., Carboxyethylthicarbimide and its Derivatives (pp. 324-344). *Tutton, A. E.*, Connection between the Atomic Weight of Contained Metals and the Crystallographical Character of Isomorphous Salts. The Volume and Optical Relationships of the Potassium, Rubidium and Cæsium Salts of the Monoclinic Series of Double Sulphates $R_2 . M . (SO_4)_2 . 6H_2O$ (pp. 344-495). *Tutton, A. E.*, Comparison of the Results of the Investigation of the Simple and Double Sulphates containing Potassium, Rubidium, and Cæsium and General Deductions therefrom Concerning the Influence of Atomic Weight on Crystal Characters (pp. 495-507). *Tutton, A. E.*, The bearing of the Results of the Investigations of the Simple and Double Sulphates containing Potassium, Rubidium and Cæsium on the Nature of the Structural Unit (pp. 507-526). *Law, R.*, An Auxiliary Assay Balance (pp. 526-530). *Ruhemann, S.*, and *Tyler, E. A.*, Contributions to the Knowledge of Ethylic Acetoacetate. I., Acetonylmalic Acid (pp. 530-536). *Burrell, B. A.*, Analysis of the Water from the Dropping Well at Knaresborough, in Yorkshire (pp. 536-539). *Wood, T. B.*, *Spivey, W. T. N.*, and *Easterfield, T. H.*, Charas. The Resin of Indian Hemp (pp. 539-546). *Fenton, H. J. H.*, The Constitution of a new Dibasic acid, resulting from the Oxidation of Tartaric acid (pp. 546-563). Presidential Address (pp. 563-571).

Vol. xv. No. 5. *Journal of the Society of Chemical Industry.* (30th May, 1896.)

Cross, C. F., and *Bevan, E. J.*, Artificial Silk (Lustro-Cellulose) (pp. 317-319). *Orsman, W. J.*, The Action of Carbon Monoxide and Coal Dust in Promoting Colliery Explosions (pp. 319-320). *Clayton, G. C.*, Chlorine as a Disinfectant (pp. 320-322). *Carey, E.*, Exports of Heavy Chemicals (p. 322). *Hogg, T. W.*, On Blister Steel and some Points concerning its Formation (pp. 323-325). *Carulla, F. J. R.*, The Corrosion of Iron by Raw Tar (pp. 325-326). *Archbutt, L.*, An Evaporation Test for Mineral Lubricating Oil (pp. 326-328). *Richardson, F. W.*, and *Aykroyd, H. E.*, "Cachon de Laval" (pp. 328-332). *Hendrick, J.*, Experiments with Bordeaux Mixture as a Preventive against Potato Disease (pp. 332-335). *Stewart, D. R.*, The Standard of Flash-Point for Mineral Oil (pp. 335-336). *Hawkins, J. D.*, The Chlorination of the Gold Ores (pp. 336-339). *Love, E. G.*, The Effect of Compression of Illuminating Gas upon its Candle-Power (pp. 339-340).

Vol. xli. No. 253. *Philosophical Magazine and Journal of Science.* (June, 1896.)

McIntosh, D., On the Calculation of the Conductivity of Mixtures of Electrolytes having a common Ion (pp. 510-517). *Roberts-Austen, W. C.*, On the Diffusion of Metals (pp. 524-528).

Tome viii. Series 7. *Annales de Chimie et de Physique.* (June, 1896.)

Limb, C., Mesure directe des forces électromotrices en unités absolues électromagnétiques (pp. 145-240). *Varet, R.*, Recherches sur les combinaisons du cyanure de mercure avec les sels halogènes (pp. 240-288).

Tomes xv.-xvi. No. 10. *Bulletin de la Société Chimique de Paris.* (20th May, 1896.)

Moureu, C., Sur la présence de l'argon et de l'hélium dans une source d'azote naturelle (pp. 626-627). *Bertrand, G.*, Préparation biochimique du sorbose (pp. 627-631). *Meunier, J.*, Sur le dichloralglucose et sur le monochloralglucosane (pp. 631-633). *Rousset, L.*, Action des chlorures d'acides sur les éthers oxydes des naphtols en présence du chlorure d'aluminium (pp. 633-638). *Reverdin, F.*, Sur quelques dérivés iodés de l'anisol et sur un cas de migration de l'atome d'iode (pp. 638-646). *Moureu, C.*, Sur la vératrylamine (pp. 646-651). *Moureu, C.*, Synthèse du méthyleugénol. Constitution de l'eugénol (pp. 651-654). *Moureu, C.*, Sur la méthylène-pyrocatéchine (pp. 654-656). *Moureu, C.*, Synthèse de l'isosafrol. Constitution du safrol et de l'isosafrol (pp. 656-661). *Causse, H.*, Sur le tartrate de phénylhydrazine et ses dérivés (pp. 661-666). *Gossart, E.*, Méthode pour la recherche des falsifications des essences végétales (pp. 666-688).

Tomes xv.-xvi. No. 11. (5th June, 1896.)

Senderens, J. B., Action du fer sur les azotates métalliques en dissolution. Allotropie et passivité du fer (pp. 691-700). *Delépine, M.*, Sur une nouvelle méthode de séparation des méthylamines (pp. 701-714). *Cazeneuve, P.*, Sur un nouveau mode de préparation synthétique de l'urée et des urées composées symétriques (pp. 714-715). *Collet, A.*, Action du chlorure de propionyle α-bromé sur le benzène en présence du chlorure d'aluminium (pp. 715-717). *Prud'homme, M.*, Condensation d'hydrols et d'amines aromatiques en présence d'acide sulfurique concentré (pp. 717-720). *Prud'homme, M.*, Sur les parafuchsines benzylées (pp. 720-723). *Cazeneuve, P.*, Sur un caractére distinctif de la fuchsine ordinaire et de la fuchsine acide S. Sur la réaction de Schiff (pp. 723-724). *Gossart, E.*, Méthode pour la recherche des falsifications des essences végétales III. (pp. 724-742).

Tome cxxii. No. 19. *Comptes Rendus hebdomadaires de l'Académie des Sciences.* (11th May, 1896.)

Schloesing, T., Les nitrates dans les eaux potables (pp. 1030-1038). *Besson, A.*, Action du gaz bromhydrique sur le chlorure de thiophosphoryle (pp. 1057-1060). *Thomas, V.*, Action de l'air et du peroxyde d'azote sur quelques composés halogénés du bismuth (pp. 1060-1062). *Bouveault, L.*, Action du chlorure d'éthyloxabyle sur les hydrocarbures aromatiques en présence du chlorure d'aluminium (pp. 1062-1064). *Delepine, M.*, Sur une nouvelle méthode de séparation de méthylamines (pp. 1064-1066).

Tome cxxii. No. 20. (18th May, 1896.)

Bertrand, J., Note sur la théorie des gaz II. (pp. 1083-1085). *Moissan, H.*, Préparation et propriétés de l'uranium (pp. 1088-1093). *Chauveau, A.*, Sur la transformation de la graisse en hydrate de carbone dans l'organisme des animaux non alimentés (pp. 1098-1103). *Tommasi, D.*, Sur un nouvel électrolyseur (pp. 1122-1123). *Varet, R.*, Recherches sur le cyanure de nickel (pp. 1123-1125). *Dufau, E.*, Sur un tétrachromité de baryoum cristallisé (pp. 1125-1127). *Hanriot*, Sur les chloraloses (pp. 1127-1130). *Cazeneuve* et *Moureu*, Sur quelques urées aromatiques symétriques (pp. 1130-1132). *Bertrand, G.*, Sur les rapports que existent entre la constitution chimique des composés organiques et leur oxydabilité sous l'influence de la laccase (pp. 1132-1135). *Lindet, L.*, Caractérisation et séparation des principaux acides contenus dans les végétaux (pp. 1135-1137).

Tome cxxii. No. 21. (26th May, 1896.)

Boltzmann. Sur la théorie des gaz (pp. 1173-1174). *Raoult, F. M.*, Sur les tensions de vapeur des dissolutions faites dans l'acide formique (pp. 1175-1177). *Besson, A.*, Action du gaz iodhydrique et de l'iodure de phosphonium sur le chlorure de thiophosphoryle (pp. 1200-1202). *Delacre, M.*, Sur l'hydratation de la pinacoline (pp. 1202-1206). *Cazeneuve, P.*, Sur un nouveau mode de préparation de l'acide glycérique (pp. 1206-1207. *Beauveault, L.*, Action du chlorure d'éthyloxalyle sur les hydrocarbures aromatiques en présence du-chlorure d'aluminium (pp. 1207-1209). *Guinchant*, Nouveaux dérivés des éthers cyanacéti

ques (pp. 1209-1212). *Bertrand, G.*, Sur une nouvelle oxydase. ou ferment soluble oxydant, d'origine végétale (pp. 1215-1218).

Tome cxxii. No. 22. (1st June, 1896.)

Moissan, H., et *Moureu, C.*, Action de l'acétylène sur le fer, le nickel et le cobalt réduits par l'hydrogène (pp. 1240-1244). *Guichard, M.*, Sur la molybdénite et la préparation du molybdène (pp. 1260-1272). *Delépine*, Sur les méthylamines (pp. 1272-1274). *Causse, H.*, Sur les aldéhydates de phénylhydrazine (pp. 1274-1277).

16e Année. Tome iii. No. 10. *Journal de la Pharmacie et de Chimie.* (15th May, 1896.)

Cazeneuve, P., Sur un nouveau mode de préparation synthétique de l'urée et des urées composées symétriques (pp. 481-482). *Marie, T.*, Sur quelques dérivés des acides cérotique et mélissique (pp. 482-488). *Klobb, T.*, Sur quelques nouveaux dérivés des éthers cyanacétiques (pp. 488-491). *Mallat, A.*, Échelle alcaline des eaux minérales naturelles du bassin de Vichy (pp. 491-493).

16e Année. Tome iii. No. 11. (1st June, 1896.)

Petit, A., et *Terra., P.*, Sur le dosage de la caféine dans le thé (pp. 529-534). *Marie, T.*, Comparaison entre les dérivés des acides des cires et les dérivés des acides des graisses (pp. 534-536). *Soulard*, Analyse d'un liquide pleurétique (pp. 536-539). *Lafay, L.*, Analyse d'un liquide de tumeur parotidienne; épithélioma glandulaire lobulé (pp. 539-543). *Moulin, L.*, Sur une réaction nouvelle de l'asparagine (p. 543).

Tome xxviii. No. 3. *Journal de la Société Physico-Chimique Russe.*

Sapochnikoff, A., Sur les proprietés des solutions aqueuses de l'acétone (pp. 223-278). *Markownikoff, W.*, Sur la source minérale de Narzane (pp. 278-283). *Andres, L.*, Action du zinc et de l'éther bromobutyrique sur l'aldehyde benzoique (pp. 283-293). *Cucuhesko, J.*, Synthèse de l'acide diméthylisobutylènelactique (pp. 293-299). *Melikoff, P.*, Analyse du meteorite de zmen (pp. 299-307). *Melikoff, P.*, Sur les conditions de la formation de la soude naturelle (pp. 307-311). *Ipatieff, W.*, Action du zinc sur les bromures du diméthyltriméthylène, du triméthyléthylène et de l'isopropyléthylène. *Ipatieff, W.*, Sur le diéthylallène. *Ipatieff, W.*, et *Wiltorf, N.*, Sur la combinaison de l'isoprène avec l'acide bromhydrique. *Zelinsky, N.*, et *Generosoff, A.*, Sur le méthylhexaméthylène. *Zelinsky, N.*, et *Issaeff, W.*, Acide diméthyldioxyadipique. *Zelinsky, N.*, et *Bruhamenko*, Influence du souffre sur la réfraction de l'éther tioamylique. *Gorboff, A.*, Une note. *Konowaloff, D.*, Sur l'amalgame de l'alluminium. *Konowaloff, D.*, Sur l'ethérification de l'acide oxalique. *Antipoff, J.*, Sur le pyrites contenant du thallium. *Tanatar, S.*, Sur l'acide hypoazotique. *Tanatar, S.*, Formation de la soude naturelle. *Barilowitsch, A.*, Synthèse de l'acide diméthyloxypelargonique (pp. 311-328.

Jahrgang xxix. No. 9. *Berichte der Deutschen Chemischen Gesellschaft.* (8th June, 1896.)

Palmer, A. W., und *Brenke, W. C.*, Ueber symmetrisches Triamidotoluol (pp. 1346-1347). *Schunck, E.*, und *Marchlewski, L.*, Zur Chemie des Chlorophylls (pp. 1347-1352. *Vorländer, D.*, und *Hobohm, K.*, Ueber die Einwirkung von Benzaldehyd auf Diäthylketon (pp. 1352-1354). *Schiff, H.*, Ueber Desamidoalbumin (pp. 1354-1356). *Niementowski, St.*, Zur Kenntniss der Oxydationsvorgänge in der Chinazolinreihe (pp. 1356-1361). *Goldschmidt, C.*, Ueber die Einwirkung von Formaldehyd auf Phenylhydrazin in saurer Lösung (pp. 1361-1362). *Unger, O.*, und *Hofmann, K. A.*, Zur Kenntniss des Thiodiphenylamins (pp. 1362-1369). *Goldschmidt, H.*, und *Reinders, R. U.*, Untersuchungen ueber die Geschwindigkeit des Uebergangs von Diazoamidoksperm in Amido-azoverbindungen (pp. 1369-1377). *Fischer, E.*, Configuration der Weinsäure (pp. 1377-1383). *Bamberger, E.*, Ueber die Zusammensetzung der Isodiazohydroxyde (pp. 1383-1388). *Bamberger, E.* Schlusserklärung (pp. 1388-1390). *Löb, W.*, Neue Arbeitsmethoden der organischen Chemie (pp. 1390-1392). *Winterstein, E.*, Ueber das Oxim des salzsauren Glucosamins (pp. 1392-1394). *Hantzsch, A.*, Vorläufige Notiz ueber untersalpetrige Säure (p. 1394). *Traute, J.*, Ueber Racemie (pp. 1394-1397). *Meyer, V.*, Notizen zur Chemie der Esterbildung (pp. 1397-1402). *Weisse, K.*, Ueber die Einführung eines vierten Radicals an Stelle von Hydroxyl in das Triphenylcarbinol

(pp. 1402-1404). *Hirtz, H.*, Ueber die Einwirkung von Brom auf aromatische Jodverbindungen (pp. 1404-1411). *Meyer, V.*, und *Pemsel, W.*, Notiz ueber eine eigenthümliche Zersetzung des Dijodacetylens (pp. 1411-1413). *Meyer, V.*, Ueber Diacetylmesitylen (pp. 1413-1415). *Kehrmann, F.*, und *Hertz, M.*, Ueber den Einfluss der Substituenten auf die Oximbildung der Chinine (pp. 1415-1420). *Luchmann, A.*, Beiträge zur Kenntniss der halogenisirten Amine der Fettreihe (pp. 1420-1434). *Bromberg, O.*, Zur Kenntniss der Phtalazin derivate (pp. 1434-1442). *Nietzki, R.*, Die Constitution der Safranine (pp. 1442-1446). *Haeussermann, C.*, und *Leichmann, H.*, Ueber einig-Abkömmlinge des Phenyläthers (pp. 1446-1450). *Francis, F. E.*, Ueber Orthodinitroe benzylbenzidin und einige Derivate (pp. 1450-1454). *Ludwig, E.*, Ozonhaltige Aldehyde zum Nachweise minimalster Mengen Jod neben Chlor und Brom (pp. 1454-1457). *Cross, C. F.*, *Bevan, G. J.*, and *Smith, C.*, Die Constitution der Cellulosen der Cerealien (pp. 1457-1462). *v. Miller W.* und *Plöchl, J.*, Zur Stereochemie der Stickstoffverbindungen (pp. 1462-1473). *Goldschmidt, C.*, Ueber die Einwirkung von Formaldebyd auf *as*-Methyl phenylhydrazin in saurer Lösung (pp. 1473-1474). *Dermstaedter, L.* und *Lifschütz, J.*, Beiträge zur Kenntniss der Zusammensetzung der Wollfettes (pp. 1474-1477). *Tanatar, S.*, Fumarsaures Hydroxylamin und dessen Zersetzungsproducte (pp. 1477-1479). *Börnstein, E.*, Ueber die Einwirkung von Benzolsulfochlorid auf Nitrosodimethylanilin (pp. 1479-1488). *v. Kostanecki, St.* und *Rossbach, G.*, Ueber die Einwirkung von Benzaldehyd auf Acetophenon (pp. 1488-1495). *v. Kostanecki, St.* und *Tamber, J.*, Ueber die Einwirkung von Alkalien auf Benzalacetophenon und Benzaldiacetophenon (pp. 1495-1497). *Hinsberg, O.* und *Koller, P.*, Ueber die Einwirkung der Aldehyde auf aromatische Orthodiamine IV. (pp. 1497-1504). *Bischoff, C. A.*, Studien ueber Verkettungen, X. Combinationen, welche zu Estern der Methylacetylentetracarbonsäure (Butansäure -2- methylsäure -3- dimethylsäure) führen sollten (pp. 1504-1514). *Bischoff, C. A.*, Studien ueber Verkettungen, XI. Combinationen, welche zu Aethylacetylentetracarbonsäureester (Pentansäure -2- methylsäure -3- dimethylsäureester) führen sollten (pp. 1514-1521). *Gassmann, C.*, Zur Bildung der Binitronaphtaline, II. (pp. 1521-1522). *Hantzsch, A.* und *Davidson, W. B.*, Ueber Diazophenole (pp. 1522-1536. *Paal, C.*, Berichtigung (p. 1536).

Band xvii. Heft 2. *Monatshefte für Chemie und verwandte Thiele anderer Wissenshaften.* (23rd April, 1896.)

Wegscheider, R., Ueber das Verhalten der Opiansäure und ihrer Ester gegen einige Aldehydreactionen (pp. 111-121). *Ebner, V. v.*, Weitere Versuche ueber die Umkehrung der Doppelbrechung leimgebender Gewebe durch Reagentien (pp. 121-126). *Kohn, L.*, Ueber die Einwirkung des alkoholischen Kalis auf den Isovaleraldehyd (pp. 126-149). *Reich, A.*, Synthetische Versuche in der Terpentinreihe (pp. 149-172). *Weidel, H.*, und *Roithner, E.*, Ueber den Abbau einiger Säureamide (pp. 172-191). *Herzig, J.*, Ueber eine Isomerie beim Acetylaurin (pp. 191-199), *Schrölter, H.*, Beitrage zur Kenntniss der Albumosen. III. (pp. 199-205).

Band xii. Heft 2. *Zeitschrift für Anorganische Chemie.* (9th May, 1896.)

Sulc, O., Ueber das sogenannte elektrolytische Silbersuperoxyd (pp. 89-98). *Relgers, J. W.*, Ueber die Stellung des Tellurs im periodischen Systeme (pp. 98-118). *Gooch, F. A.*, und *Peirce, A. W.*, Ueber eine Methode zur Trennung des Selens vom Tellur, beruhend auf der verschiedenen Flüchtigkeit ihrer Bromide (pp. 1181-24). *Jannasch, P.*, und *Lehnert, H.*, Ueber quantitative Metalltrennungen in Alkalischer Lösung durch Wasserstoffsuperoxyd (pp. 124-129). *Jannasch, P.*, und *Lehnert, H.*, Ueber die Bestimmung des Schwefels in anorganischen Sulfiden durch Glühen derselben in einem Sauerstoffstrome und Auffangen der flüchtigen Oxyde in Wasserstoffsuperoxyd (pp. 129-132). *Jannasch, P.*, und *Lehnert, H.*, Trennung des Quecksilbens von anderen Metallen durch Glühen ihrer Sulfide in einem Sauerstoffstrome (pp. 132-134). *Jannasch, P.*, Ueber Trennungen des Mangans von Kupfer und Zink. (Wasserstoffhyperoxydmethode), sowie des Kupfers von Zink und Nickel (Schwefelwasserstoff und Rhodanmethode) nebst ergänzenden Bemerkungen (pp. 134-143). *Jannasch, P.*, Ueber eine empfindlich form der Quecksilberjodidreaktion (pp. 143-146). *Hofmann, K. A.*, Ueber das Nitroprussidnatrium (pp. 146-168).

Band xii. Heft 3. (6th June, 1896.)

Piccini, A., Die Superoxyde in Beziehung zu dem periodischen System der Elemente (pp. 169-180). *Sulc, O.*, Ueber das sogenannte elektrolytische Silbersuperoxyd (pp. 180-182).

Flawitzky, F., Eine Hypothese ueber die Atombewegung der Elemente und die Entstehung der letzteren (pp. 182-188). *Larsson, A.*, Untersuchungen ueber Niob (pp. 188-208). *Jannasch, P.*, und *Heidenreich, O.*, Ueber die Aufschliefsung der Silikate durch Borsäure II. (pp. 208-219). *Jannasch, P.*, Ueber das Verhalten der Mineralien der Andalusitgruppe gegen Aufschliefsungsmittel I. (pp. 219-223). *Jannasch, P.*, Eine neue Methode der Ueberführung von Sulfaten in Chloride (pp. 223-225). *Arctowski, H.*, Versuche Ueber die Flüchtigkeit des roten Phosphors (pp. 225-229).

Band xx. Heft 1. *Zeitschrift für Physikalische Chemie.* (29th May, 1896.)

Rogóyski, K., und *Tammann, G.*, Ueber adiabatische Volumenänderungen an Lösungen (pp. 1-19). *Jakowkin, A. A.*, Ueber die Dissociation polyhalogener Metallverbindungen in wässeriger Lösung (pp. 19-40). *Whitney, W. R.*, Untersuchungen ueber Chromsulfat Verbindungen (pp. 40-68). *Morley, E. W.*, Ueber die Dichten von Sauerstoff und Wasserstoff und ueber das Verhältnis ihres Atomgewichte (pp. 68-131). *Linebarger, C. E.*, Ueber die Dielektrizitätskonstanten von Flüssigkeitsgemischen (pp. 131-139).

Anno xxvi. Vol. 1. Fascic. iv. *Gazzetta Chimica Italiana.* (16th May, 1896.)

Feliciani, G, Analisi chimica dell'acqua acetosa di Roma (Ponte Motle) (pp. 281-289). *Lamberti-Zanardi*, Azione del cloro sul benzoilnitrocarbazol (pp. 289-293). *Antony, U.*, e *Gigli, G.*, Sulla decomposizione idrolitica del nitrato e del solfato ferrico (pp. 293-311). *Zanninowich, T. W.*, Dissociazione eleltrolitica delle soluzioni in acido formico (pp. 311-323). *Ponzio, G.*, Sulla preparazione dei senfoli alifalici e sul leso compostamento con l'idrogeno solforato (pp. 323-327). *Longi, A.*, e *Bonaria, L.*, Sulle determinazioni volume trische del piombo (pp. 327-403).

APPENDIX.

CHEMICAL LITERATURE FOR JUNE, 1896.

Vol. xviii. No. 6. *American Chemical Journal.* (June, 1896.)

Linebarger, C. E., On the Specific Gravities of Mixtures of Normal Liquids (pp. 429-453). *Orndorff, W. R.*, and *Bliss, C. L.*, Dianthranol—A Dihydroxyl Derivative of Dianthracene (pp. 453-465). *Jackson, C. L.*, and *Calvert, S.*, Bromine Derivatives of Metaphenylene Diamine (pp. 465-490). *Bushong, F. W.*, On Benzimidoethyl and Benzimidomethyl Ethers (pp. 490-491). *Kastle, J. H.*, *Keiser, B. C.*, and *Bradley, E.*, On the Halogen Derivatives of the Sulphonamides (pp. 491-502). *Stickney, D.*, The Reduction of Copper Sulphide (pp. 502-504).

Vol. xviii. No. 6. *Journal of the American Chemical Society.* (June, 1896.)

Ewell, E. E., and *Wiley, H. W.*, The Effect of Acidity on the Development of the Nitrifying Organisms (pp. 475-484). *Leeds, A. R.*, Standard Prisms in Water Analysis and the Valuation of Color in Potable Waters (pp. 484-491). *Bryant, A. P.*, A Method for Separating the "Insoluble" Phosphoric Acid in Mixed Fertilisers Derived from Bone and other Organic Matter from that Derived from Rock Phosphate (pp. 491-498). *Auchy, G.*, Sources of Error in Volhard's and Similar Methods of Determining Manganese in Steel (pp. 498-511). *Saarbach, L.*, A Simple Form of Gas Regulator (pp. 511-514). *Linebarger, C. E.*, A Rapid Method of Determining the Molecular Masses of Liquids by Means of their Surface Tensions (pp. 514-532). *Delafontaine, M.*, and *Linebarger, C. E.*, On the Reaction between Carbon Tetrachloride and the Oxides of Niobium and Tantalum (pp. 532-536). *Osborne, T. B.*, and *Campbell, G. F.*, The Chemical Nature ot Diastase (pp. 536-542). *Osborne, T. B.*, and *Campbell, G. F.*, The Proteids of Malt (pp. 542-558).

Vol. xxi. No. 244. *The Analyst.* (July, 1896.)

Voelcker, J. A., and *E. W.*, Note on the Composition of Two Deposits formed in Water-pipes (pp. 169-171). *Mitchell, C. A.*, The Composition of Human Fat (pp. 171-174). *Allen, A. H.*, On the Composition and Analysis of Commercial Cream of Tartar (pp. 174-182). *Wiley, H. W.*, and *Ewell, E. E.*, Determination of Lactose in Milks by Double Dilution and Polarisation (pp. 182-186). *Shepherd, H. H. B.*, Official Methods for the Analysis of Fertilisers, issued by the German Manure Manufacturers' Association (pp. 186-191).

Vol. lxix. No. 403. *Journal of the Chemical Society.* (June, 1896.)

Playfair, Lord, Personal Reminiscences of Hofmann and of the conditions which led to the establishment of the Royal College of Chemistry and his appointment as its Professor (pp. 575-580). *Abel, F. A.*, The History of the Royal College of Chemistry and Reminiscences of Hofmann's Professorship (pp. 580-596). *Perkin, W. H.*, The Origin of the Coal-Tar Colour Industry, and the Contributions of Hofmann and his Pupils (pp. 596-637). *Armstrong, H. E.*, Notes on Hofmann's Scientific Work (pp. 637-733). *Japp, F. R.*, and *Lander, G. D.*, Condensation of Benzil with Ethylic Acetoacetate (pp. 736-748). *Walker, J.*, and *Henderson, J.*, Electrolysis of Potassium Alloethylic Camphorate (pp. 748-759). *Dixon, H. B.*, *Strange, E. H.*, and *Graham, E.*, The Explosion of Cyanogen (pp. 759-774). *Dixon, H. B.*, The Mode of Formation of Carbonic Acid in the Burning of Carbon Compounds (pp. 774-789). *Dixon, H. B.*, and *Harker, J. A.*, On the Detonation of Chlorine Peroxide (pp. 789-792). *Bablich, H.*, and *Perkin, A. G.*, Morin. I. (pp. 792-799). *Perkin, A. G.*, Luteolin. II. (pp. 799-804). *Cross, C. F.*, *Bevan, E. J.*, and *Smith, C.*, Constitution of the Cereal Celluloses (pp. 804-818). *Purdie, T.*, and *Williamson, S.*, Ethereal Salts of Optically Active Malic and Lactic Acids (pp. 818-839). *Dunstan, W. R.*, and *Goulding, E.*, The Hydriodides of Hydroxylamine (pp. 839-842). *Hartley, W. N.*, The Determination of the Composition of a "White Sou" by a Method of Spectragraphic Analysis (pp. 842-844). *Hartley, W. N.*, On the

Temperature of Certain Flames (pp. 844-848). *Chattaway, F. D.*, and *Evans, R. C. T.*, Metadichlorobenzine (pp. 848-851). *Dixon, A. E.*, Halogen Additive Products of Substituted Thiosinnoamines (pp. 851-855). *Dixon, A. E.*, Acidic Thiocarbimides, Thioureas, and Ureas (pp. 855-869). *Aymons, W. H.*, and *Stephens, F. R.*, Carbon Dioxide: Its Volumetric Determination (pp. 869-881).

Vol. xv. No. 6. *Journal of the Society of Chemical Industry.* (30th June, 1896.)

Wall, E. J., Chromatic Photography (pp. 400-404). *Gowland, W.*, Japanese Metallurgy: I. Gold and Silver and their Alloys (pp. 404-414). *Cowper-Coles, S.*, The Electro-Deposition of Zinc (pp. 414-417). *Coste, J. H.*, Notes on Laboratory Apparatus (pp. 417-418). *Clowes, F.*, Acetylene: Limits of Explosibility of Mixtures with Air, and Detection of Small Proportions in Air (pp. 418-419). *Paton, J. M. C.*, The Amount of Air contained in Water (pp. 419-420). *Barnes, J.*, Titanium Oxide as a Mordant for Wool, together with a Note on Zirconium and Cerium Oxides (pp. 420 422). *Hummel, J. J.*, and *Brown, R. B.*, The Dyeing Properties of Catechin and Catechir-Tannic Acid (pp. 422-426). *Jenks, R. L.*, The Hide-Powder Filter (pp. 426-427). *Diusberg, C.*, The Education of Chemists (pp. 427-432). *Thompson, G. W.*, On the Analysis of White Paints (pp. 432-434). *Dewey, F. P.*, Accuracy in Silver Assays (pp. 434-436). *Waller, E.*, Analysis of Chrome Ores (pp. 436-437).

Vol. xlii. No. 254. *Philosophical Magazine and Journal of Science.* (July, 1896.)

Witkowski, A. W., Thermodynamic Properties of Air (pp. 1-37). *Holman, S. W.*, *Lawrence, R. R.*, and *Ban, L.*, Melting points of Aluminium, Silver, Gold, Copper, and Platinum (pp. 37-52). *Wildermann, M.*, Note on the Degree of Dissociation of Electrolytes at O' (pp. 102-103). *Thompson, S. P.*, On Hyperphosphorescence (pp. 103-107).

Vol. lix. No. 357. *Proceedings of the Royal Society.* (18th June, 1896.)

Ramsay, W., Helium, a Gaseous Constituent of certain Minerals. II. Density (pp. 325-330). *Gamgee, A.*, On the Relations of Turacin and Turacoporphyrin to the Colouring Matter of the Blood (pp. 339-342). *Lockyer, J. N.*, On the New Gas obtained from Uraninite. VII. Remarks on Messrs. Runge & Paschen's Diffusion Experiment (pp. 342-343).

Tome viii. Series 7. *Annales de Chimie et de Physique.* (July, 1896.)

Moissan, H., Recherches sur les différentes variétés de carbone. I. Etude du carbone amorphe (pp. 289-306). *Moissan, H.*, Recherche sur les différentés variétés de carbone. II. Etude du graphite (pp. 306-347). *Cotton, A.*, Recherches sur l'absorption et la dispersion de la lumière par les milieux doués du pouvoir rotatoire (pp. 347-432).

Tomes xv.-xvi. No. 12. *Bulletin de la Société Chimique de Paris.* (20th June, 1896.)

Thomas, V., Sur le bichlorure de bismuth (pp. 758-760). *Thomas, V.*, Action de l'air et du peroxyde d'azote sur le bromure et iodure de bismuth (pp. 760-762). *Fonzes-Diacon*, Action du bichlorure de mercure sur les alcools (pp. 762-763). *Cazeneuve*, P., Sur un nouveau mode de préparation de l'acide glycérique (pp. 763-764). *Bertrand J.*, Sur quelques cétones de la série grasse à poids moléculaires élevés (pp. 764-768). *Guinchant*, Nouveaux dérivés des éthers cyanacétiques (pp. 768-772). *Klobb, T.*, Sur quelques acides cyanés nouveaux (pp. 773-778). *Grimaux, E.*, Note sur l'anéthol (pp. 778-779). *Prud'homme*, M., Propriétés des fuchsines; leur oxydation par le peroxyde de plomb (pp. 780-783). *Biétrtx, A.*, Action de la phénylhydrazine sur l'acide gallique et sur l'acide dibromogallique (pp. 783-786). *Quiroga, A.*, Argine. Arginine (pp. 787-791). *Bertrand, G.*, Sur les rapports qui existent entre la constitution chimique des composés organiques et leur oxydabilité sous l'influence de la laccase (pp. 791-793). *Bertrand, G.*, Sur une nouvelle oxydase ou ferment soluble oxydant, d'origine végétale (pp. 793-797). *Moreigne, H.*, Sur un nouveau corps (raphanol) retiré de la racine de raphanus niger ou radis noir (crucifères) et de quelques autres plantes de la même famille.—Considérations sur l'essence de raphanus niger (pp. 797-803). *Revière, G.*, et *Bailhache, G.*, Etude du procédé Kjeldahl et modifications à y apporter (pp. 806-811). *Petit, A.*, et *Terrat, P.*, Sur le dosage de la caféine dans le thé (pp. 811-115).

Tomes xv.-xvi. No. 13. (5th July, 1896.)

Ferreira da Silva, A. J., Sur la constitution des Carbonyles métalliques (pp. 835-838). *Tommasi, D.*, Procédé électrolytique pour l'extraction, la séparation et l'affinage des métaux (pp. 838-842). *Causse, H.*, Sur les aldéhydates de phénylhydrazine (pp. 842-846). *Patein, G.*, et *Dufau. E.*, Des combinaisons de l'antipyrine avec les acides oxybenzoïques et leurs dérivés (pp. 846-850). *Hébert, A.*, et *Truffaut, G.*, Etude physiologique des cyclamens (1) (pp. 850-855). *Aglot*, Dosage optique de l'acide sulfurique (pp. 855-862). *Deniges, G.*, Méthode générale pour le dosage du mercure sous une forme quelconque (pp. 862-871).

Tome cxxiii. No. 23. *Comptes Rendus hebdomadaires de l'Académie des Sciences.* (8th June, 1896.)

Moissan, H., Etude de la fonte et du carbure de vanadium (pp. 1297-1302). *Moissan, H.*, Sur une nouvelle méthode de préparation des alliages d'aluminium (pp. 1302-1303). *Chauveau, A.*, Sur la nature du processus chimique qui préside à la transformation du potentiel auquel les muscles empruntent l'énergie nécessaire á leur mise en travail (pp. 1303-1309). *Boltzmann*, Sur la théorie des gaz (pp. 1314). *Raoul, F. M.*, Influence de la température du réfrigérant sur les mesures cryoscopiques (pp. 1315-1319). *De Grammont, A.*, Sur les spectres des métalloïdes dans les sels fondus. Soufre (pp. 1326-1328). *Fabre, C.*, Sur le dosage de la potasse (pp. 1331-1333). *Marshall, D.*, Sur la chaleur de vaporisation de l'acide formique (pp. 1333-1335). *Patein, G.*, et *Dufau*, Combinaisons de l'antipyrine avec les acides oxybenzoïques et leurs dérivés (pp. 1335-1338). *Trouvé, G.*, Sur l'éclairage á l'acétylène (pp. 1338-1342). *Griffiths, A. B.*, Sur la composition du pigment rouge d'Amanita muscaria (pp. 1342-1343).

Tome cxxii. No. 24. (15th June, 1896.)

Carnot, A., Sur les variations observées dans la composition des apatites (pp. 1375-1380). *Sabatier, P.*, Sur une réaction des composés cuivreux pouvant servir à caractériser les azotites (pp. 1417-1419). *Hallopeau, L. A.*, Sur les combinaisons zirconotungstiques (pp. 1419-1422). *Barbier, P.*, et *Bouveault, L.*, Synthèse de la méthylhepténone naturelle (pp. 1422-1424).

Tome cxxii. No. 25. (22nd June, 1896.)

Moissan, H., Sur la formation des carbures d'hydrogène gazeux et liquides par l'action de l'eau sur les carbures métalliques. Classification des carbures (pp. 1462-1467). *Sabatier, P.*, Sur l'acide nitrosodisulfonique bleu foncé (pp. 1479-1482). *Combes, C.*, Sur la préparation des alliages d'aluminium par voie de réaction chimique (pp. 1482-1484). *Granger, A.*, Sur l'action du phosphore sur quelques chlorures métalliques (pp. 1484-1486). *Cavalier, J.*, Mesure d'une chaleur d'éthérification par l'action du chlorure d'acide sur l'alcool sodé (pp. 1486-1488). *Rivals, P.*, Sur l'acétal et l'acétal monochloré (pp. 1488-1489). *Rivals, P.*, Sur les éthers éthyliques des acides acétiques chlorés (pp. 1489-1491). *Bouveault, L.*, Action de l'hydrazine sur les acides glyoxyliques de la série aromatique (pp. 1491-1493). *Guerbet* et *Behal, A.*, Sur la constitution de l'acide campholénique inactif (pp. 1493-1496). *Balland*, Sur la valeur nutritive des farines et sur les conséquences économiques d'un blutage exagéré (pp. 1496-1499). *Bach, A.*, Sur le mécanisme chimique de la réduction des azotates et de la formation de matières azotées quartenaires dans les plantes (pp. 1499-1502). *Jacquemin, G.*, Dénaturation rationnelle de l'alcool (pp. 1502-1503).

Tome cxxii. No. 26. (29th June, 1896.)

De Gramont, A., Sur le spectre du phosphore dans les sels fondus et dans certains produits métallurgiques (pp. 1534-1537). *Sabatier, P.*, Sur l'acide nitrosodisulfonique bleu et sur quelques-uns de ses sels (pp. 1537-1539). *Thomas, V.*, Action de l'iode sur le chlorure stanneux (pp. 1539-1541). *Aloy, J.*, Recherches thermiques sur les composées de l'uranium (pp. 1541-1543). *Bouveault, L.*, Nouvelle méthode pour la préparation d'aldehydes aromatiques (pp. 1543-1545). *Biétrix, A.*, Recherches sur la chloruration de l'acide gallique. Formation d'acide dichlorgallique et de trichloropyrogallol (pp. 1545-1548). *Minguin*, Propriétés cristallographiques des benzylidène, méthyl- et éthyl-salicidènes, et anisal camphres (pp. 1548-1550). *Hébert, A.*, Sur un nouvel acide gras non saturé, l'acide isanique (pp. 1550-1553).

16e Année. Tome iii. No. 12. *Journal de Pharmacie et de Chimie.*
(15th June, 1896.)

Bourquelot, E., Sur la présence dans le Monotropa hypopytis d'un glucoside de l'éther méthylsalicylique et sur le ferment soluble hydrolysant de ce glucoside (pp. 577-582). *Causse, H.*, Sur le tartrate de phénylhydrazine et ses dérivés (pp. 582-589). *Georges*, Sur le chlorhydrosulfate de quinine (pp. 589-594). *Matrot, A.*, Dispositif pour maintenir la constance du niveau d'un liquide dans un récipient (pp. 594-595). *Cazeneuve*, Sur un caractère distinctif de la fuchsine ordinaire et de la fuschine acide. S. Sur la réaction de Schiff (pp. 595-597).

16e Année. Tome iv. No. 1. (1st July, 1896.)

Thibault, P., Etude sur le dosage polarimétrique du lactose contenu dans le lait de femme (pp. 5-10). *Moreigne, H.*, Sur un nouveau corps (Raphanol) retiré de la racine de Raphanus niger du radis noir (crucifères) et de quelques autres plantes de la même famille. Considerations sur l'essence de Raphanus niger (pp. 10-16). *Cazeneuve, P.*, Sur un nouveau mode de préparation de l'acide glycérique (pp. 16-18). *Lindet, L.*, Caractérisation et séparation des principaux acicles contenus dans les végétaux (pp. 18-21). *Planchon, L.*, Le commerce actuel de l'herboristerie dans une région du Languedoc (pp. 21-25).

Tome xxviii. No. 4. *Journal de la Société Physico-Chimique Russe.*

Speransky, A., Sur le rhodanure de chrome (pp. 329-335). *Zelinsky, N.*, et *Tchernosvitoff, N.*, Sur les acides diméthyltricarballyliques stereoisomères (pp. 335-345). *Tchernik, G.*, Sur un minéral céritique du district de Batoum (345-360). *Barilovitch, A.*, Synthèse et propriétés de l'acide diméthyloxypelargonique (pp. 360-365). *Rabinovitch, J.*, Analyse de l'eau du lac salé de Golopristan (pp. 365-371). *Petrenko-Kritchenko, P.*, et *Stanichevsky, J.*, Sur la condensation des aldéhydes et des éthers acétondicarboniques (pp. 371-374). *Tanatar, S.*, Sur l'acide hypoazotique libre (pp. 374-376). *Tanatar, S.*, Sur la formation de la soude naturelle (pp. 376-384). *Antipoff, J.*, Sur les pyrites contenant du thallium (pp. 384-388). *Wagner, E.*, *Ertchikovsky, G.*, et *Ginsberg, A.*, Sur la structure des terpènes ; *Worms, W.*, Sur les méthodes de l'acidimétrie ; *Worobieff, N.*, Sur les hydrates de sulphate de cadmium et de chlorate de cadmium ; *Lubarsky, E.*, Sur le hydrate de l'aluminium chlorate, contenant neuf molécules d'eau ; *Lubarsky, E.*, Sur les hydrates des sels halogéniques du Zink ; *Lubarsky, E.*, Sur les hydrates de bromure et iodure de calcium, contenant six molécules d'eau ; *Tanatar, S.*, Sur la décomposition de l'hydroxylamène fumarique ; *Giliaroff, A.*, Sur le synthèse de l'acide triméthyléthylénélactique. *Ginsberg, A.*, Sur un appareil perfectionné pour la distillation sous pressiodn iminuée (pp. 388-398).

Band ccxxxiv. Heft 5. *Archiv der Pharmacie.* (24th June, 1896.)

Gildemeister, E., und *Stephan, R.*, Ueber Palmarosaöl (pp. 321-330). *Kassner, G.*, Beitrag zur Kenntniss der Ferricyansalze und ihrer Anwendung als Oxydationsmittel (pp. 330-348). *Schaer, E.*, Ueber die Einwirkung des Morphiums sowie des Acetanilids auf Mischungen von Ferrisalz und Kaliumferricyanid (pp. 348-367). *Pommerehne, E.*, Ueber die Einwirkung von Jodmethyl auf Xanthinsalze (pp. 367-380). *Toppelius, H.*, und *Pommerehne, E.*, Ueber Kreatinine verschiedenen Usprungs (pp. 380-397). *Hoehnel, M.*, Zur Kenntniss der Metaplumbate (pp. 397-400).

Jahrgang xxix. No. 10. *Berichte der Deutschen Chemischen Gesellschaft.*
(22nd June, 1896.)

Weil, H., Die Constitution der Farbbasen der Triphenylmethanreihe (pp. 1541-1543). *Auwers, K.*, und *v. Campenhausen, F. G.*, Ueber Oxytrimethylbernsteinsäure (pp. 1543-1549). *Emmerling, O.*, Untersuchung einer Emaille (pp. 1549-1550). *Scholl, R.*, und *Matthaiopoulos, G.*, Zur Kenntniss der α- Halogenketoxenie (pp. 1550-1559). *Piloty, O.*, Ueber eine Oxydation des Hydroxylamins durch Benzolsulfochlina (pp. 1559-1567). *Willgerodt, C.*, Rationelle Darstellungsweisen von Jodoverbindungen (pp. 1567-1575). *Willstälter, R.*, Zur Kenntniss von Tropinin und Nontropinin. III. (pp. 1575-1585). *Heidenreich, M.*, Quantitative Analyse durch Elektrolyse (pp. 1585-1590). *Einhorn, A.*,

Ueber die Reduction der Benzylamincarbonsäuren (pp. 1590-1595). *Wallach, O.*, Ueber Condensationsproducte cyclisher Ketone und Synthesen innevhalb der Terpengruppe (pp. 1595-1602). *Fischer, O.*, und *Dischinger, A.*, Ueber die Oxydationsproducte des Orthoamidodiphenylamins (pp. 1602-1609). *Friedlænder, P.*, und *Rüdt, H.*, Untersuchungen ueber isomere Naphtalinderivate. III. (pp. 1609-1613).

Band liii. Nos. 8, 9. *Journal für praktische Chemie.* (9th May, 1896.)

Stohmann, F., und *Schmidt, R.*, Ueber den Wärmewerth der Hippursäure, ihrer Homologen und der Anisursäure (pp. 345-369). *Schickler, P.*, Zur Kenntniss eines neuen Kohlenwasserstoffes $C_{14}H_{12}$ (pp. 369-375). *Edinger, A.*, Zur Kenntniss des Jodisochinolins und der beiden isomeren Jod- o- Phtalsäuren (pp. 375-390). *Claus, A.*, und *Setzer, E.*, Zur Kenntniss des ana- Nitro- und des o- Amido- Chinolins (pp. 390-414). *Busch, M.*, Zur Kenntniss des o- Amidobenzylamine. III. (pp. 414-427). *Walter, J.*, Beitrag zur Erklärung der Sandmeyerischen Reaction (pp. 427-431). *Ponzio, G.*, Einwirkung von Salpetersäure auf aliphatische Aldehyde (pp. 431-432).

Band liii. Nos. 10, 11. (9th June, 1896.)

Walther, R., Ueber Reduktion mittelst Phenylhydragins (pp. 433-472). *Walther, R.*, Ueber die Einwirkung von Orthoameïsenäther auf primäre aromatische Amine (pp. 472-478). *Troeger, J.*, und *Eggert, A.*, Ueber die Einwirkung von Thiophenol auf Diketone der aromatischen Reihe (pp. 478-484). *Troeger, J.*, und *Artmann, K.*, Ueber ungesältigte Sulfone der Naphtalivreihe (pp. 484-501). *Stoehr, C.*, und *Branetes, P.*, Synthese von Trimethylpyrazin und Tetramethylpyrazin (pp. 501-512).

Band xvii. Heft 3. *Monatshefte für Chemie und verwandte Theile anderer Wissenschaften.* (30th May, 1896.)

Braun, L., Ueber die Einwirkung von Isobutyraldehyd auf Malon- und Cyanessig-Säure (pp. 207-225). *Gregor, G.*, Zur Constitution der Monoäthyl-β-Resorcylsäure (pp. 225-229). *Heilpern, J.*, Ueber das sogenannte Carbothiacetonin (pp. 229-245). *Wegscheider, R.*, Ueber das Phenylhydrazin und Oxim des Proto-catechu-Aldehyds (pp. 245-253). *Brunner, K.*, Eine Indoliumbase und ihr Indolinon (pp. 253-281).

Jahrgang xxxv. Heft 3. *Zeitschrift für Analytische Chemie.* (20th May, 1896.)

Beckmann, E., Beiträge zur Prüfung des Honigs (pp. 263-285). *Schjerning, H.*, Noch einige Bemerkungen ueber die quantitative Trennung der in Bierwürze vorhandenen Proteïnstoffe (pp. 285-297). *Kolk, J. L. C. S.*, Doppelverbindungen von Anilin mit Metallsalzen. I. (pp. 297-305). *Riegler, E.*, Eine neue Bestimmungs-methode der löslichen Jodverbindungen auf titrimetrischem Wege (pp. 305-308). *Riegler, E.*, Zur Literstellung der Thiosulfatlösung mittelst Jodsäure (pp. 308-309). *Vedrödi, V.*, Zur Bestimmung des Nicotins und des Ammoniaks im Tabak (pp. 309-311). *Ritter, G. v.*, Ueber die quantitative Bestimmung des Zinks in organischen Salzen (pp. 311-314). *Aufschläger, H.*, Ueber das Verhalten stickstoffhaltiger organischer Körper gegen Mehrfachschwefelkalium bei Löherer Temperatur (pp. 314-318). *Leceo, M. T.*, Ueber das Vorkommen von Jod im Wasser (pp. 318-322). *Belar, A.*, Prufüng der Rothweine auf fremde Farbstoffe (pp. 322-324). *Dierbach, K.*, Ein neuer Bunsen-Brenner (pp. 324-325). *Frexnius, H.*, und *Makin, C. J. L.*, Ueber die Bestimmung des Phenols in Seisen und Desinfectionsmetheln (pp. 325-334).

Band xxii. Heft 1. *Zeitschrift für Physiologische Chemie.* (16th May, 1896.)

Baumann, E., Ueber den Jodgehalt der Schilddrüsen von Menschen und Thieren. III. (pp. 1-16). *Roos, E.*, Ueber die Wirkung des Thyrojodins (pp. 16-62). *Nultall, G. H. F.*, und *Theerfelder, H.*, Thierisches Leben ohne Bakterien in Verdauumgskanal. II. (pp. 62-74). *Kossel, A.*, und *Neumann, A.*, Ueber Nucleïnsäure und Thyminsäure (pp. 74-82). *Schulze, E.*, Ueber das Vorkommen von Nitraten in Keimpflangen (pp. 82-90). *Schulze, E.*, und *Winterstein, E.*, Ueber einen phosphorhaltigen Bestandtheil der Pflangensamen (pp. 90-95). *Krüger, T. R.*, Ueber die Abspaltung von Koblensäure aus Phosphorfleischsäure durch Hydrolyse (pp. 95-102).

Anno xxvi. Vol. I. Fascicolo 5 e 6. *Gazzetta Chimica Italiana.*
(28th June, 1896.)

Oddo, G., e *Leonardi, G.*, Sul mononitrite dell' acido canforico e le trasposizioni atomiche dell' isonitrosocanfora (pp. 405-423). *Ponzio, G.*, Azione dell' acido nitrico sulle aldeidi alifatische (pp. 423-425). *Tarugi, N.*, Sull' amalgama di platino e sua applicazione nella chimica analitica (pp. 425-431). *Piutti, A.*, e *Giustiniani, E.*, Sui derivati maleinici di alcune ammine grasse (pp. 431-441). *Minunni, G.*, e *Rap, E.*, Ricerche sui prodotti di ossidazione degli idrazoni. I. Ossidazione del benzalfenilidrazone (pp. 441-456. *Minunni, G.*, e *Vassallo, D.*, Nuove ricerche sulla trasformazione delle α- aldossime in nitriti (pp. 456-466). *Bartoli, A.*, Il coefficiente di compressibiliia degli idrocarburi $C_n H_{2n} + 2$ (pp. 466-472). *Bartoli, A.*, e *Stracciati, E.*, Sul calore specifico volume costante degli idrocarburi $C_n H_{2n} + 2$ dei petroli di Pensilrania (pp. 472-475). *Bartoli, A.*, Sulla scelta dell' unità di calore (pp. 475-483). *Carrara, G.*, e *Zoppellari, J.*, Velocità di reazione in sistemi non omogenei. II. Scomposizione coll' acqua di alcune combinazione dello zolfo e del fosforo (pp. 483-494). *Vianello, M. N.*, Sulla velocità di formazione dei xantogenati alcalini (pp. 494-501).